PUBLIC WORKS

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AND MANY OTHER VALUABLE ARTICLES
SEE PAGE 5



Robert A. Reed is Highway Superintendent of Steuben County, New York, in which position he is responsible for construction and maintenance of highways, bridges and related county structures. See also page 18.



GALION From START to FINISH

With GALION Graders, contractors find their important jobs are seldom delayed because of grading operations. Clay, shale, sand, rock, or weather make little difference — GALIONS push thru on schedule.

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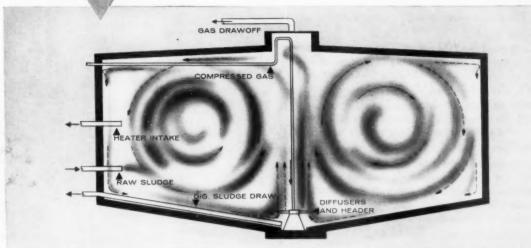


"Chicago"

the Accelerated Sludge Digestion System...for Unparalleled Savings

Only CRP* Has Achieved These Results

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- Sludge digestion without scum



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THIS IS THE CRP* PROCESS

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The CRP* Gas Treating System provides . . .

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CRP* was tested and proven scientifically for seven (7) years prior to introduction to the field. The completely successful operation in 18 Municipal Plants since 1953, has verified this system.

Consulting Engineers may obtain specific data from Chicago Pump Company or Distributors located in most principal cities...concerning the application of CRP* to plants under design or plants requiring expansion.

in successful operation
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Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

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1958 Chicago Pump Company



NEW Caterpillar No. 933 Series F Traxcavator delivers up to 22% more production

The new Caterpillar No. 933 Series F Traxcavator with a larger, 11/8 cu. yd. bucket is ready now to set new production records. It is the latest achievement of Caterpillar's "Project Paydirt*."

Field tests on a variety of jobs and working conditions proved the new Series F delivers up to 22 per cent more production than previous models of this popular machine.

The power source of the new No. 933 is an efficient new 52 HP Cat Diesel Engine. It features a new cylinder block, engine balancer for smooth performance, unit-serviced fuel pump, and a side-mounted starting engine for compactness and economy.

A new transmission and a heavier final drive give the new No. 933 the speed and stamina to maintain quick, easy loading and faster cycling. Cycle time is further shortened by a high-speed reverse—3.67 MPH.

The new machine features greater operator comfort and efficiency. All controls are conveniently visible. Leg room is ample. The mechanical advantage of the steering clutch brakes has been increased 30% for easier operation. A new, larger seat is more comfortable, continues to provide good visibility, both front and back.

And the new No. 933 retains the superior design features that have made Traxcavators first choice on jobs throughout the world. The exclusive oil clutch, automatic bucket controls, 40° tilt-back, heavy-duty undercarriage, unit design and construction — to name just a few. And the exclusive Side Dump Bucket is available to add versatility.

Get the complete story on the new No. 933 from your Caterpillar Dealer. Ask him to demonstrate how this Traxcavator can step up production on your job,

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.



HIGHER PRODUCTION and more profits are possible with the new Caterpillar No. 933 Series F Traxcavator featuring a $1\frac{1}{8}$ cu. yd. bucket.

* PROJECT PAYDIRT: Caterpillar's multi-million-dollar research and development program — to meet the continuing challenge of the greatest construction era in history with the most productive earthmoving machines ever developed.

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PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

MARCH 1959 . VOLUME 90, NUMBER 3

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TWO ROLL ENGINES (Formerly LE ROI) Supply Heat and Power for entire Sewage Treatment Plant

City of Oshkosh, Wis., sewage treatment plant powered by two Model F-1500 Roiline Engines—1503 cu. in. displ., 6%-in. bore x 7-in. stroke, counterbalanced crankshaft—each 215 max. hp at 1200 rpm.

For details, send for Bulletin E-9.

Operating continuously, but alternately...one engine working, the other standing by...two F-1500 ROILINES, driving 50 KW generators, supply heat and power for this entire sewage treatment plant, including the digestors. It is not unusual for ROILINES in service like this to run 30,000 hours or more without major overhaul.

Not only dependable power but low up-keep

num pistons, precision bearings, full flow oil filters, sectional water-cooled exhaust manifolds, large main bearings, full pressure lubrication, and other big features.

ARIZONA, Casa Grande, Engine Service Company, Inc. ARKANSAS, Paragould, Wonder State Manufacturing Co. CALIFORNIA, Long Beach, Engine & Equipment Company COLORADO, Denver, Emrick & Hill Engine & Equipt. Co. ILLINOIS, Centralia, John Nickell Company KANSAS, Garden City, Carson Machine & Supply Co. LOUISIANA, Shreveport, Ingersoll Corporation—MICHIGAN, Reed City, Hafer Engine Company OHIO, Columbus 19, Cantwell Machinery Company

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and long service life is built into ROILINE Engines, With a close-to-perfection combustion

chamber that gives you more horsepower per

fuel dollar. With full length guided valve stem mechanisms, light weight cam ground alumi-

PENNSYLVANIA, Pittsburgh 34, P. C. McKenzie Company TEXAS, Houston 1, Southern Engine & Pump Co.

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WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN

New York • Tulsa • Los Angeles Factories: Waukesha, Wisconsin and Clinton, low?



Standardization in Bridge Design Can Save Time and Money

THE NUMBER of bridges needed for our highway system is surprisingly large, averaging perhaps nearly one per mile of road. In the past each major bridge and many of the smaller ones have presented special problems in design, requiring much engineering computation and the use of more or less specially prepared components. Study is now under way toward standardizing certain elements common to nearly all larger bridges and toward creating a package type of bridge in suitable widths and for spans up to 80 or 100 ft. If such standardized bridges were available to cities, states, counties and townships, they would greatly reduce the time required for engineering design; but more important, they could represent a very substantial saving in construction cost.

The Myth of the Lowest Bid

AN OLD MYTH that dies hard is the one that public purchases are always made on the basis of the low bid, irrespective of how good or how poor the material is. This belief is an insult to the skilled engineers who are responsible for the technical services of cities, counties and states. Moreover, it is necessary only to look at the list of firms manufacturing and supplying equipment for public works, and to analyze their standing in the field, to disprove this myth once more. The reputation of these firms and the acceptance of their products have been based on quality, not cheapness; and both reputation and acceptance are visible proofs that engineers know what good material is and are able to get it for their communities.

Floods and Flood Plain Development

SOMETIMES IT SEEMS that our floods are getting bigger with each passing year, though the record of flood flows does not bear this out. However, despite our flood control programs, extensive damages are caused each year by unusually high storm runoff. This is due largely to the little or no control exercised over building or development in flood plain areas. The natural channel may be constricted, making high water more destructive; but generally the larger damages arise because there is more damageable construction in the flood zone.

Memory of floods is often short; real estate developers may have forgotten, or may not know, past flood history; and so it is unlikely they will mention flood hazards to potential purchasers. So development continues, inviting loss. Perhaps it is time to consider regulation of flood plain occupancy by proper zoning or planning.

Reducing the Cost of Refuse Collection But Not the Quality of Service

N COLLECTING refuse, labor costs will usually represent 70 percent to 80 percent of the total. Equipment costs, including depreciation, repairs and maintenance, make up most of the remainder. Because of the large labor costs, a wider use of the most modern and efficient equipment for collection can yield cost savings that, in many communities, will be surprising. This is especially true in the case of county refuse collection systems which represent a growing field of use, but it applies to very many cities and villages also.

A Sewage Treatment Plant is No Good Until It Is Built

NE SEWAGE treatment plant in being and treating sewage is better than a dozen in the design stage being readied for possible approval by reluctant voters. In our opinion there has been too much effort spent on grandiose projects which are designed to blanket a metropolitan area with a coordinated system of sewers and one big treatment plant. As sound as such projects may be, if they develop-and they are by no means always the perfect solution-they have too often resulted in the finest kind of excuses for doing nothing by the governmental units in the area.

In comparison with the highway industry and the educational groups, both of which have programs to meet post war needs, progress in solving the waste disposal problem has been little better than pitiful. There has been a lack of leadership at all levels of government; it may be that this is a result of subordinating sanitary engineering to the broader phases of medical health work; or it may be that the desire to accomplish the ideal job—the grandiose project-has left no time for anything else. Whatever the basic reason, no one can be proud of the nation-wide accomplishments to date in providing adequate sewage disposal.

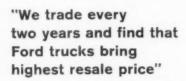
Heavy Construction Operators

Go FORD WARD for greater payload... power ..

"Our Ford trucks haul up to a ton-and-a-half more payload per trip"

says William R. Collins, V.P. William Collins and Sons, Fargo, N.D.

"We switched to Ford trucks in 1951 because we found we could haul 1½ tons more per trip. Now we have 124 Fords, including 80 T-700's. They're economical to operate, too—we get up to 6 miles per gallon. Our drivers like Ford's power steering and peppy 302 HD V-8 engine. We like Fords because we know we can always get Ford parts quickly if we need them. That means our trucks aren't down over one day, even on a major overhaul."



says John McCormick, Sec.-Treas. NorthernImprovementCo.,Fargo,N.D.

"We keep our Ford T-700's in top condition year round, and it pays off. We get a higher resale price when we trade every two years. Fords have the ability to perform under the rugged conditions in our work. Power steering on our tandem dumps makes them easy to handle on-or off-the road.





"Our drivers like Ford's power... they get heavy loads under way fast"

says George C. Wilson, General Superintendent Schultz and Lindsay Construction Co., Fargo, N. D.

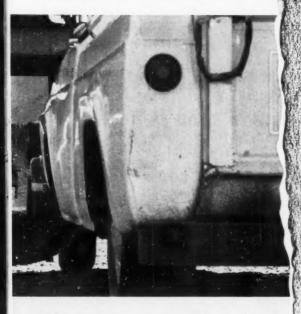
"Ford's HD power in our T-750's gets heavy loads under way fast . . . helps keep us on schedule. And we can haul bigger payloads doing it . . . up to a yard more, legally, every trip. We've never had frame trouble either. They're rugged, durable trucks and if we ever need Ford parts, we can always get them at the nearest town."

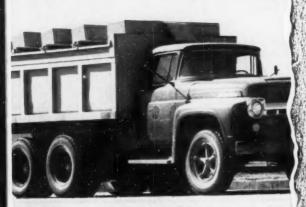
FORD TRUCKS COST LESS

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CERTIFIED PROOF
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CERTIFIED
by America's foremost
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Send inquiry to: P.O. Box 2687
Ford Division, Ford Motor Co.
Detroit 31, Michipan

`59 Ford Pickups Win Economy Showdown U.S.A.

-average 25.2% better gas mileage!

Impartial tests of the 1959 pickup models of all six makes prove conclusively that Ford's %-ton pickups equipped with Short Stroke Sixes are the economy champs for '59.

HOW TESTS WERE MADE

Standard six-cylinder models of the six leading half-ton pickups first were put through exhaustive road trials. All '59 trucks—Ford and competitive—were bought from dealers, just as you would buy them. After at least 600 miles break-in, all were brought up to manufacturer's recommended specifications.

The trucks were then tested — by America's leading independent automotive testing firm—at constant speeds of 30, 45 and 60 miles an hour. Next came stop-and-go tests, ranging from moderate city traffic to normal retail delivery operation. Acceleration rates were carefully timed in each gear to insure accurate results for all makes.

| Н | OW NEW | '59 SIX | ES RATE | IN GAS | MILEAC | SE |
|------------------------------|--|--|--|--|--|--|
| '59 FORD SIXES GIVE | 25.2% more miles per gallon than Make | 31.1% more miles per gallon than Make | 9.6% more miles per gallon than Make 14G ⁷⁷ | 42.6% more miles per gallon than Make | 22.0% more miles per gallon than Make 44\$77 | 25.2% more miles per gallor than the average of all makes |

The '59 Ford Sixes, in every test, averaged more miles per gallon than every other make! Combining all tests, the '59 Fords led the average of all other '59 pickups by 25.2%.

WHAT'S THE SECRET?

How can a '59 Ford Six make four gallons do the work of five in other trucks?

First, of all pickup Sixes, only Ford has modern Short Stroke design. This new type of engine is basically far more efficient than long-stroke Sixes of other pickups. Example: Ford's Six delivers more usable horsepower than any other pickup Six.

Second, to this modern engine Ford has added a new economy carburetor. By metering fuel more precisely in both lowand high-speed ranges, Ford's new carburetor boosts gasoline mileage in every type of driving. And Ford's Economy Carburetor is standard at no extra cost.

Your Ford Dealer now has the complete report of Economy Showdown U.S.A. Why not call or visit him today and get the whole story firsthand?

BIG AD CAMPAIGN WARNS OF GROWING WATER PROBLEM!

Urges local support for better water systems

CAST IRON PIPE RESEARCH ASSOCIATION OFFERS LOCAL PLAN-OF-ACTION BOOKLET

Here's help for you and everyone else directly concerned with the supply, treatment and distribution of water—help that will acquaint the people in your town with the vital importance of this growing problem.

On the opposite page you see the second in a series of advertisements, this one appearing in April Reader's Digest. Placed by the Cast Iron Pipe Research Association, these striking advertisements point out to Mr. and Mrs. America how much we depend on a good water system and why we can no longer take it for granted.

Similar advertising will appear regularly in U. S. News & World Report, Nation's Business, Better Homes & Gardens, American Home and Sunset magazines to carry this public service message to millions of civic leaders and homeowners.

FREE LOCAL HOW-TO-HELP BOOKLET

These ads offer a free booklet telling about the water problem. It shows how responsible citizens can acquaint themselves with the needs of their community. It also gives a step-by-step outline of

action, telling how they can help their officials extend and improve the local water system through more adequate rate structures or financing.

Let us send you a free copy of this new booklet. Write to Thos F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Ill.



THREE REASONS WHY CAST IRON PIPE IS AMERICA'S GREATEST WATER CARRIER:



- More miles of underground cast iron water mains are now in use than of all other kinds of pipe combined.
- More miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.
- 3. Impartial surveys prove that today's consulting engineers and water utility officials prefer cast iron pipe for underground water distribution by an overwhelming majority.

CAST IRON PIPE



Oh, what will you do without water?

Indeed there is. In the last five years over 1000 U.S. communities have

had to ration water. It's growing less plentiful all the time. Will you run dry? It depends on you.



Now, what can you do about water?

This free booklet, "WATER-

This tree bookiet, "WATER— make sure you'll always hare plenty," tells how to learn if you're running short, what to do if you are. Write Cast Iron Pipe Research Assn., Prudential Plaza, Chicago 1, Ill. short, what to do if you are. Write

Printed in your interest by the makers of America's greatest water carrier . . .

CAST IRON PIPE

PUT THE SQUEEZE ON INFILTRATION

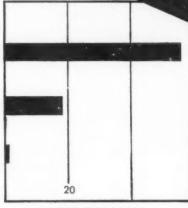
WITH

AMERICAN-MARIETTA Rubber Gasketed Pipe

ORDINARY

A-M FLAT-TYPE GASKETS

AMSEAL® or AMBAND



INFILTRATION
GALLONS/INCH/HR/MILE

American-Marietta flat-type gaskets and longer length pipe reduce leakage and provide savings through faster installation with fewer joints.

For positive control of infiltration specify AMSEAL (Rubber and Steel Joints) or AMBAND (Fiberglass-Resin-Collar Joints).



AMERICAN-MARIETTA COMPANY

CONCRETE PRODUCTS DIVISION

GENERAL OFFICES:

AMERICAN-MARIETTA BUILDING

101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

How to be comfortable... and still do a "Finishing Man's" Job



Whether you're shining a slope or skimming the high spots off a haul road, you can do a better job... easier with the Allis-Chalmers FORTY FIVE motor grader. If comfort means topnotch visibility in any grading position—a big, clean deck without a clutter of shin-busters and toe-tanglers—and friendly controls that don't fight back...if all this is grader comfort, then the Allis-Chalmers FORTY FIVE is the lap of luxury.

Come on and take a look at the FORTY FIVE . . . Judge for yourself!

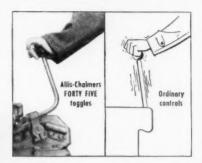
No matter what size or shape you are when you climb into the cab of a FORTY FIVE, you can't help but feel the extra roominess. And leave your hat on, too—if you're under 6 foot 6 . . . because there's plenty of head room. Now look all around . . . there's over 35 square feet of safety glass to look through. The FORTY FIVE'S big, one-piece windshield gives you more visibility than any other grader . . . extends below the steering column on both sides, too, so you can see the heel of the blade easily when you're sitting down.



With or without a cab, the FORTY FIVE'S clean, flat deck gives you more unobstructed foot room than any other grader. No "tangle-foot" when you need to hit that clutch quickly on a steep slope. The FORTY FIVE's new suspended brake and clutch pedals give you even more foot room than before... and they're feather-light to operate. Foot-controlled accelerator/decelerator makes it real handy to creep along in tight quarters... around culverts... on

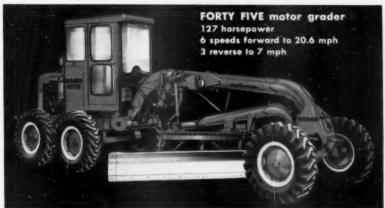
slippery slopes—leaves both hands free to control the blade and steer.

Try the "toggle test," too. Take hold of the FORTY FIVE's "kickfree" toggles. You can give the blade control all she's got without any



wrist-snapping backlash. The FORTY FIVE will save you many a painful hand and wrist strain when you're splitting hairs on a blue-topping job, or cutting a fine shoulder swath. You'll appreciate that smooth, precision blade control that lets you skim a 10th of an inch when and where you want to. And, the FORTY FIVE's extra-high blade lift—higher than any other grader—lets you climb out of a ditch without gouging up finished foreslopes.

These are typical of all the FORTY FIVE's "operator extras" that help you work easier . . . look better than on any other machine. Don't take anybody's word for it! You'll never really know all the "bigtime" features of the Allis-Chalmers FORTY FIVE until you've had the feel of it in the dirt. The Allis-Chalmers dealer nearest you will be glad to let you try a FORTY FIVE. Go see him next time you have a day off. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



move ahead with ALLIS-CHALMERS...power for a growing world



The new lift span on the Celilo Bridge over the Columbia River is being raised to permit river passage. Westinghouse supplied all the major elements of the electrical system, which can raise the span to 75 feet above mean high water in 90 seconds.



Sid Brown, Westinghouse sales representative, at right, is shown discussing approval of electrical control system with Mr. Don Thomas, assistant engineer of structures for Spokane, Portland and Seattle Railway; Mr. Glen Emory and Mr. Ed Bohm, partners of Emory and Bohm, electrical contractors.



Celilo Railway Lift Bridge uses new Westinghouse static skew control

When construction of the Dalles Dam caused the Columbia River to rise closer to the deck of the Oregon Trunk Railway's Celilo Bridge, it became necessary to build a lift span to let river traffic pass beneath. A Westinghouse d-c adjustable-voltage drive, incorporating static skew control, was installed to provide smooth acceleration and a precise regulating system to keep the span level.

Set between two towers, the span is counter-weighted and suspended by wire ropes passing over sheaves at the top of each tower. Two Westinghouse d-c mill motors in each tower drive the sheaves and are electrically synchronized by the d-c adjustable-voltage system to keep the span level when operating. The various operations are so interlocked that they must follow a predetermined sequence to assure maximum equipment and personnel safety. The skew control equipment has safeguards against abnormal conditions and requires minimum maintenance.

Westinghouse equipment used on the Celilo Bridge includes: the main d-c drive motors, brakes, motor-generator, control regulating exciters, control board, an operator's console, emergency drive a-c gearmotors and a 225-kva outdoor power center.

Westinghouse, as sole supplier of the coordinated electrical system, assumed undivided responsibility for its overall operation. For further information showing how this complete, single-source supply can benefit you, contact your Westinghouse electrical construction engineer, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

Owner: Oregon Trunk Railway (Operated by Spokane, Portland & Seattle Ry.)

Consulting Engineers: Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.

General Contractor: Kansas City Bridge Co., Kansas City, Mo.

Steel Fabricators: Pacific Car & Foundry Co., Seattle, Wash.

Electrical Contractor: Emory and Bohm, Portland, Oreg.

Westinghouse Distributor: Westinghouse Electric Supply Company, Portland, Oreg.

YOU CAN BE SURE ... IF IT'S

Westinghouse





Chief operator, Champ King, at Westinghouse control desk. This desk centralizes the starting and stopping of railway traffic, selection of normal, auxiliary or emergency power supply, normal or emergency drive system and control of the lock and lift span.



Mr. Brown and Mr. Thomas inspect the interior of the main control cabinet which houses the Magamp* regulator panel and Rototrol® elements of the bridge control system.

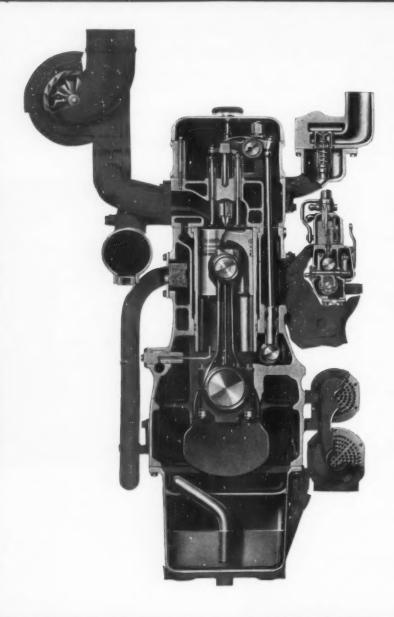
*Trade-Mark



Mr. Bohm and Mr. Thomas examine the Westinghouse 33-hp Type MCA d-c mill motors, designed for heavy intermittent duty, which drive the main span machinery located at top of each tower.

BOW FOR THE FIRST TIME

ILEMATIONAL UDT



Here's the all-new direct start 385 max. hp International UDT-817—a compact, heavy-duty 4-cycle, 6-cylinder engine thoroughly proven in six years of development and testing—backed by 26 years of experience in manufacturing and selling over 400,000 heavy-duty diesel engines.

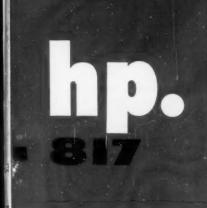
Designed for versatile application in a wide variety of rugged municipal applications, the UDT-817 answers the demand for dependable high power and lower cost operation on compressors and standby pumps and generator sets.

A wide variety of accessory equipment including air cleaners, flywheels for leading makes of torque converters and clutches, torque converter cooler, air control compressors, safety shut-offs, instruments and engine controls can be furnished to meet your installation requirements. Base, radiator, hood and dash, clutch and power take-off are available for complete power units.

For more specific information or application assistance, merely call your nearby International Power Unit Distributor or Dealer.

BRIEF SPECIFICATIONS

| Type4-cycle turbocharged |
|--------------------------|
| Bore and Stroke |
| Number of Cylinders |
| Displacement |
| Max hp |
| Rated hp |
| Max. Torque |
| Compression Ratio |
| Weight3,540 lb. |
| Lbs. per max. hp |
| Length, fan to flywheel |
| Height |
| Width 391/2" |
| Flywheel housing SAE |





FEATURES THAT PROVIDE DEPENDABLE, ECONOMICAL POWER

- Fast direct starts with 24-volt electrical system.
- Direct injection of fuel under pressures to 20,000 psi by individual camshaft actuated multi-orifice injectors.
- Exclusive IH twin plunger metering pump directs equal and precise amounts of fuel to each injector in proper firing order according to load and speed demands.
- Turbocharger puts waste energy in exhaust gases to work for higher power output and lower fuel consumption.

- Dual intake and exhaust valves for free breathing efficiency.
- Positive valve rotators keep valve seats free of deposits.
- Aluminum alloy pistons working in replaceable wet cylinder sleeves with velocity swirl flow water cooling on outside, jet oil cooling on inside, for long life operating temperatures.
- Fully counterbalanced Tocco-hardened crankshaft with seven big main bearings and torsional vibration damper for smooth, dependable high power output.



International® Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, III.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.



Massive 8 to 10-ton Austin-Western tandem roller barely kisses Detroit street curbing as it compacts

Smooth 'n' easy control lets **Detroit's Austin-Western roller** work curb kissin' close

"Our Austin-Western tandem roller is an excellent piece of equipment," says Jack Lezotte, Detroit's Department of Public Works maintenance supervisor.

Low maintenance, plenty of power

"We bought it new in April 1958 and so far it has been working a 40-hour week without any maintenance requirements other than routine servicing." Mr. Lezotte tells us. This 8 to 10-ton roller has so much power it rolls along as smooth as a baby buggy and does a precision compaction job.

"The hydraulic steering pump is a nice standard feature on the A-W. It gives plenty of smooth 'n' easy control for work so close it barely kisses the curbing." A-W hydraulic steering is safe, too, because the pump works even if the engine is off. That means sure control even when under tow or to roll down ramps or inclines in emergencies.

Other exclusive A-W features

Other exclusive A-W features include full-width seats for better visibility; long-life oversize axles and antifriction bearings; many interchangeable parts; beveled outside roller edges that won't mark hot materials

A-W tandems available in 5 to 8, 8 to 12, 10 to 14-ton models; 3-wheel rollers in 8 to 11, 10 to 12, 12 to 14-ton models. Portable tandem variable between 31/2 to 6 tons. Choice of gasoline or diesel power. Standard-2-speed transmission with torque converter or 4-speed transmission. Optional-torque converter with 4-speed transmission.

There's an A-W roller to meet your needs. Consult your nearby Austin-Western distributor or write direct.



Robert A. Reed is County Highway Superintendent of Steuben County, N. Y. This administrative position involves all types of engineering work including maintenance and construction of highways, bridges, buildings and related activities on the Highway System. There are approximately 140 employees in all categories from deputy superintendent to laborers under his jurisdiction.

Mr. Reed graduated from Cornell University in 1935 with a BS in Forestry and a minor in engineering. He was a track letter-man and a member of Quill and Dagger. His first job was secured with the USDA-Resettlement Administration as Forester in charge of woodland activities. In 1939, he was transferred to the Soil Conservation Service as Soil Conservationist. A course was completed from the University of Marquette on aerial mapping and photogrammetry in 1941. Promotions were granted which increased his responsibility for planning, designing, supervising and checking compliance for all types of conservation and engineering practice on highway erosion control, farm pond and lake construction, flood control and water conservation until 1952 when he became area conservationist for six southern tier counties of New York. In 1955. he accepted the position of Assistant Highway Supt. for Steuben County and was later appointed County Highway

He has been active over the years in Rotary, BPOE, Soil Conservation Society of America, Society of American Foresters, Belmont Industrial Association, County Superintendents' Association and Member National Society of Professional Engineers.











ALL

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FOR'59

FORD

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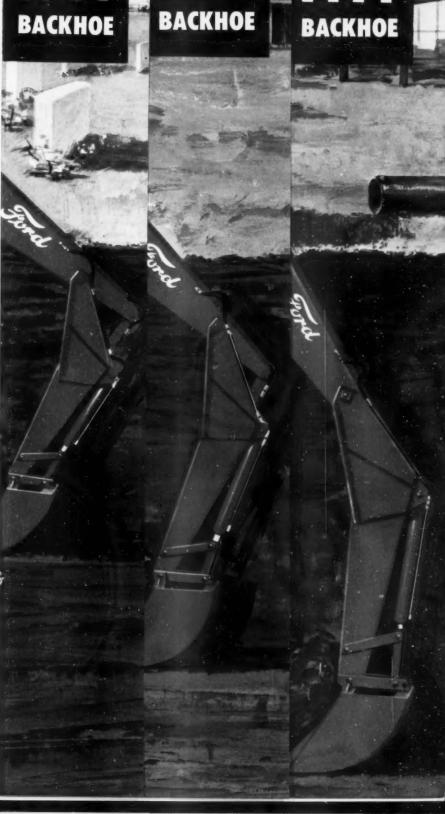
BACKHOE

FORD
12 FT
BACKHOE

FORD

4 FT

BACKHOE



FORD'S

THE LINE FOR

59

Get detailed information on:

NEW FORD 10 Ft., 12 Ft., 14 Ft., BACKHOES

NEW FORD INDUSTRIAL TRACTOR

NEW FORD SUPER-DUTY LOADER

NEW FORDSON POWER MAJOR DIESEL

SEE YOUR FORD TRACTOR AND EQUIPMENT DEALER TODAY

or write to Industrial Sales Department, Tractor and Implement Division, Ford Motor Company, Birmingham, Michigan.

YOU SEE MORE

FORDS

MORE MONEY!

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FORD FORD FORD 12 FT BACKHOE **BACKHOE BACKHOE** ALL FORDS ARE ENGINEERED FOR: Fast Digging Long reach, free drop, unmatched bucket capacities, positive swing and boom control, Ford's exclusive placement of pivot points and hydraulic cylinders— all work together for faster production and greater lengths of trench from a single setting. Precision Digging Instant, accurate control of boom, dipstick and bucket lets you hold trench floors to exact grade, dig plumb walls and square corners, work around underground lines, reduce costly hand finishing. Problem Digging Wide-stance stabilizers and full-power 185° swing are among the many superior Ford features which help you undercut paved surfaces, dig at full speed on slopes or at right angles, work close to buildings, in cramped quarters, on soft ground.

FORD 10 FT. BACKHOE

Dimensional specifications with Ford Workmaster Tractor

Transport length: 17'1"

Transport height: 10'4"

Seat to ground: 54"

Axle to swing post: 3'2"

Max. reach from axle: 17'4"

Reach, pivot to bucket teeth: 14'2"

Max. undercut forward of pivot: 5'7"

Reach outside tire @ 90°: 11'6"

Hydraulic pump capacity: 14 gpm (a 1700 rpm

Stabilizer, lift, bucket and crowd cylinders (double acting): piston 3" dia., rod 1\%" dia.

Swing cylinders (single acting): piston $3\frac{1}{2}$ " dia., rod $1\frac{1}{2}$ " dia.

Features offered by all Ford 10', 12' and 14' backboes are listed on last page.

FORD 10 FT. COMPARISON CHART

| FEATURE | FORD 10' | BACKHOE A | BACKHOE B | |
|--|-----------|-----------|-----------|--|
| Max. length 40" excavation | 14'3" | 11′1″ | 11' | |
| Max. digging depth | 10'8" | 9'8" | 9'8" | |
| Max. reach from swing post | 14'2" | 12'4" | 13' | |
| Max. swing | 185° | 140° | 180° | |
| Max. loading height | 9'5" | 7'4" | 8'6" | |
| Ground clearance | 131/2" | 10" | 6" | |
| Max. stabilizer spread | 120" | 78" | 83" | |
| Min. stabilizer spread (transport) | 77" | 77" | 84" | |
| Approx. weight (installed with bucket) | 2397 lbs. | 2110 lbs. | 1725 lbs. | |
| Struck capacity (cu. ft.) | | | | |
| 12" ditching bucket | 2.5 | 2.3 | 1.75 | |
| 18" ditching bucket | 4.5 | 3.2 | 2.75 | |
| 24" ditching bucket | 6.0 | 4.5 | 3.75 | |

INTEGRATED HYDRAULIC PACKAGES

Ford backhoes use an integrated hydraulic system with front-mounted loaders; or are supplied with separate pump, drive and reservoir for tractors without loaders:

- Ford 10' Backhoe with Ford Extra Heavy Duty Loader on Ford NAA, 600, 601, 800 and 801 Tractors.
- Ford 10' and 12' Backhoes with same loader on same tractors, but with bigger pump.
- All Ford Backhoes with or without Ford Super-Duty Loader on Ford Industrial Tractors.
- All Ford Backhoes without loader on Fordson Major Diesel and Fordson Power Major Tractors.

FORD FORD BACKHOE ALL FORDS ARE ENGINEERED FOR: • 5-Minute "Quick Hitch" Ford has a clamp-type hitch, uses no pins or bolts. One man can put the backhoe on or off in minutes, right on the job. It takes no special tools or equipment. There's no interference with Ford's 3-point hitch. It's ready for work with commonly used rear tools as soon as the backhoe is removed. Unmatched Stability Ford stabilizers are 10' apart when working-widest stance on the market. Stabilizers retract without manual adjustment to 77" width, carried high and close to tractor tires for transport and front loader work. Choice of five stabilizer plates - standard, sand, spike, street and special cemetery. Cushioned "No Drift" Swing Short, single-link control of boom pivot helps keep swing system snug fitting, prevents swing drift. Automatic braking prevents slamming load into extreme swing limits in normal operations.

FORD 12 FT. BACKHOE

Dimensional specifications with Ford Powermaster Tractor

Transport length: 16'10"
Transport height: 11'5"
Seat to ground: 54"
Axle to swing post: 3'2"
Max. reach from axle: 19'

Reach, pivot to bucket teeth: 15'10"

Max. undercut forward of pivot: 5'10"

Reach outside tire @ 90°: 13'1"

Hydraulic pump capacity: 14 gpm @ 1700 rpm

Stabilizer, lift and crowd cylinders (double acting): piston 3½" dia., rod 2" dia.

Bucket cylinders (double acting): piston

3" dia., rod 1¾" dia.

Swing cylinders (single acting): piston 4" dia., rod 11/2" dia.

FORD 12 FT. COMPARISON CHART

| FEATURE | FORD 12' | BACKHOE C | BACKHOE D | BACKHOE E | BACKHOE F | BACKHOE G | BACKHOE H |
|---|-----------|--------------|--------------|--------------|--------------|--------------|--------------|
| Max. length 40" excavation | 16'3" | 13'2" | 11' | 11' | 12'4" | 12'11" | 11'8" |
| Max. digging depth | 12'5" | 11' | 11′5″ | 11'5" | 12′7″ | 11'6" | 12" |
| Max. reach from swing post | 15'10" | 15'11" | 13'10" | 13'10" | 15'7" | 15'5" | 14'4" |
| Max. swing | 185° | 180° | 140°-180° | 180°-200° | 180° | 180° | 188° |
| Max. loading height | 10'7" | 10' | 8'2" | 7′11″ | 9'1" | 7'5" | 9'11" |
| Ground clearance | 131/2" | 11" | 10" | 10" | N.A. | 10" | 123/4" |
| Max. stabilizer spread | 120" | 95" | 86" | 86" | 102" | 110" | 98" |
| Approx. weight (installed with bucket). | 2685 lbs. | N.A. | 1900 lbs. | 1900 lbs. | 2095 lbs. | 2969 lbs. | 3001 lbs. |
| Struck capacity (cu. ft.) | | | | | | | |
| 12" ditching bucket | 2.5 | 2.5 | 2 | 2 | 2 | 2 | 2 |
| 18" ditching bucket | 4.5 | 4 | 3 | 3 | 3.5 | 3.25 | 3.5 |
| 24" ditching bucket | 6 | 5.5 | 4.5 | 4.5 | 5 | 4.5 | 5 |

FORD 14 FT. BACKHOE

Dimensional and performance specifications with Ford Industrial Tractor

Transport length: 18'4"
Transport height: 12'7"
Seat to ground: 54"
Axle to swing post: 3'2"

Max. reach from axle: 20'8"

Max. undercut forward of pivot: 5'10" Reach outside tire @ 90°: 14'10"

Hydraulic pump capacity: 16.4 gpm @ 1700 rpm

Stabilizer and bucket cylinders (double acting): piston 3½" dia., rod 2" dia.

Lift and crowd cylinders (double acting): piston 4" dia., rod 21/4" dia.

Swing cylinders (single acting): piston $4\frac{1}{2}$ " dia., rod 2" dia.

Max. length 40" excavation: 16'2"

Max. digging depth: 14'1"

Max. reach from swing post: 17'6" Max. swing: 185°

Max. loading height: 11'8" Ground clearance: 13½" Max. stabilizer spread: 120"

Min. stabilizer spread (transport): 77"
Approx. weight (installed w/bucket):

2905 lbs.

Struck capacity (cu. ft.) 12" ditching bucket: 2.5

18" ditching bucket: 4.5

24" ditching bucket: 6.0

24" high capacity ditching bucket: 7.0



FORD 14 FT. COMPARISON CHART

(there's never been anything approaching this model short of big expensive equipment)

FORD FORD 1841 INDUSTA ALL FORDS ARE ENGINEERED FOR: Four Major Lift Advantages 1. Power from largest side of piston on lift, when meeting most resistance. 2. Straight-up transport position, better stability. 3. Excellent dump height. 4. Unmatched reach for undercutting forward of tractor rear axle. Four Major Crowd Advantages 1. Power from largest side of piston on crowd, when meeting most resistance. 2. Excellent leverage provided through entire crowd stroke. 3. Directs resistance force back to heavy boom, not to dipper stick. 4. Permits combination of work actions for efficient, faster digging. Four Major Curl Advantages 1. Power from largest side of piston when curling bucket through ground resistance. 2. Precise bucket positioning. 3. Maintains high average tooth force during bucket rotation. 4. Clean sweep action; no interference; no heel drag.

No matter what kind of HOLE, consider the WHOLE . . .

HERE ARE 55 EXCELLENT REASONS WHY A FORD BACKHOE WILL DO YOUR JOB BEST!

Quick Hitch

- 1. Close-coupled for good balance, stability.
- 2. Clamp-type hitch; no pins or bolts.
- 3. One man puts on or off in 5 minutes; no special tools.
- 4. Self-storing unit.
- No need to disconnect pump drive; just connect un-coupled lines together and oil recirculates.
- No interference with 3-point hitch; always ready for

Cool Hydraulic System

- 7. Clean design, shortest possible lines, no sharp bends. All help keep oil cool.
- Ample oil capacity to provide full flow, maximum cycle speeds, and to prevent pump cavitation.
- Six-spool multi-purpose body valve for top speed cycling, positive control, excellent throttling.
- 10. Main relief valve backed up by separate relief valves in hydraulic lift and crowd circuits.
- No pipe, pipe threads or pipe fittings; all straight threads with "O" rings or tube fittings. Tight seal, easy service.
- 12. Minimum number of hose sizes to simplify owner maintenance.
- 13. All lines short as possible to reduce friction power losses.
- 14. Double acting cylinders throughout except for single acting swing cylinders.
- 15. All cylinders positioned for maximum force during stroke of greatest resistance.
- 16. Chevron type packing with phenolic resin back-up rings.

Rugged Construction

- 17. Backed up by Ford service warranty; one-stop parts and service; traditional good trade-in value.
- Large replaceable pivot pins and case-hardened bushings at all wear points.
- 19. Hydraulic lines inside box members for protection where possible.
- Control shroud cover easily removed to service plumbing.
- Heavy duty swing post is shock resistant malleable iron casting.
- 22. Main swing pivot pins 1¾" dia.; special thrust washer in upper bearing resists wear from boom swing.
- 23. Boom, dipper stick and stabilizer arms all welded high strength box sections for maximum brawn, minimum weight.
- 24. Box section reinforcements at main pivot points of swing post, boom and dipper stick.

Operator Convenience

- 25. All models have adjustable, full-cushioned seat with back rest.
- 26. Plenty of leg room on anti-skid deck.
- 27. Superior work visibility.
- 28. Easy to reach tractor throttle, loader controls, etc. from seat of backhoe.

Unmatched Stability

- 29. Widest stabilizer stance on market.
- 30. Narrowest stabilizer transport width on market.
- 31. Individual control of stabilizers for leveling on slopes, uneven ground.
- Wrist action pivot between each arm and stabilizer pad gives full ground contact.
- Choice of five stabilizer pads to adapt for any type of

Superior Lift

- 34. Hydraulic power from big end of piston on lift stroke, when boom meets greatest resistance.
- 35. Free fall for speed and breaking ground.
- Straight-up boom transport; closer to tractor center of
- gravity for stability. Unmatched dump height.
- 38. Unmatched undercutting capacity.

Superior Crowd

- 39. Hydraulic power from big end of piston on crowd stroke, when dipstick meets greatest resistance.
- Crowd force directed to lower end of dipper stick, near bucket pivot.
- 41. Cylinder location gives excellent leverage.
- 42. Resistance force transferred to heavy boom, not to dipper stick.
- 43. Crowd advantages are a vital part of Ford's over-all digging efficiency, permit faster production.

Superior Curl

- 44. Four-bar actuating linkage gives precise bucket posi-
- Hydraulic power from big end of piston when curling
- teeth through greatest resistance.

 46. Maintains high average bucket tooth force.
- 47. Clean sweep action; no interference; no heel drag.

Biggest Bucket Capacities

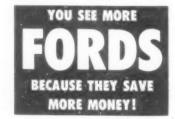
- 48. Choice of 12", 18" and 24" standard ditching buckets; 24" high capacity ditching bucket for 14' model; 32" and 36" bell hole and cemetery buckets.
- Replaceable wear points on teeth; bucket mouth flared to reduce friction.

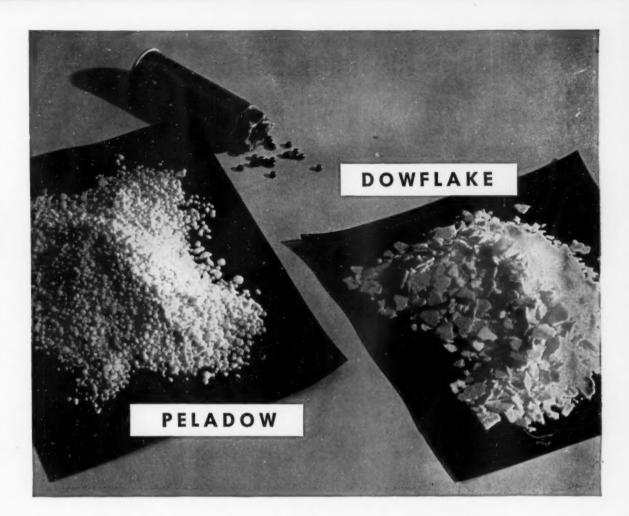
Superior Swing

- 50. Positive, instant control; no delay getting bucket back into trench for another payload.
- 51. Fine throttling or feathering of swing control valve.
 52. Combination flow and cushion valve maintains a solid
- oil circuit, prevents drifting.

 53. Short, single-link connection between each cylinder and
- swing post; no chain or cable to wear excessively.
- Short linkage reduces number of pivot points to four.
 Retarding device on swing control lever automatically brakes swing to prevent slamming into stops. Operator can over-ride to get maximum swing.

Ask your Ford Tractor and Equipment Dealer for more detailed specifications and literature on these new backhoes as well as for all the other new tractors, loaders and matching equipment in Ford's new line for '59. See him today, or write to Ford Motor Company, Industrial Sales Department, Birmingham, Michigan.





Which calcium chloride for you?

It is agreed: To improve construction of concrete roads, to maintain unpaved roads, to control ice and dust—nothing beats calcium chloride. But which calcium chloride is best for you? Flake or pellet? What concentration?

In answer, Dow offers two forms. Dowflake® comes as flakes in a 77-80% concentration; Peladow®, a 94-97% concentration, comes as buckshot-sized pellets. Both provide the faster set, increased workability, density and strength so desirable in concrete. Both stabilize unpaved roads, reduce gravel loss as much as 85%. Both control ice and dust with a cleanliness and efficiency unmatched by other materials.

And for application and handling ease, both flow freely. The important difference is this: Peladow is especially designed for bulk shipment in tank cars or covered hopper cars and is easily handled in auger type conveyors. In some areas, its high concentration cuts freight and handling costs, because you require 20% less per application. Which for you? Peladow or Dowflake?

The quantity required and how you use it will help you choose. And so will we! For information and proved recommendations, name your use and write the dow Chemical Company, Midland, Michigan, Dept. 503EC3.

YOU CAN DEPEND ON



Add to the useful life of your Trickling Filters with

VITRIFIED CLAY FLOOR BLOCKS

The useful life of a trickling filter depends on the type of underdrains. Permanence is only actual in a filter floor that can defy the destructive forces of acids, alkalis and bacterial action.

And just one proven product meets all the requirements for a trouble-free floor—vitrified clay underdrain blocks. Made in modern plants under rigid quality controls impossible for most substitute materials, they offer long-term low cost plus maximum crushing strength, higher velocity in flow, light weight and ease of laying. Also a 50-Year Guarantee against actions of acids and bacteria.

Trickling Filters are experiencing fast growing acceptance as an important factor of the national campaign against stream pollution. 2,682 such sewage works were completed by 1957, serving 35.4% of our people. The TFFI is proud of its contribution toward giving the nation clean waters for health, recreation and industry.





TRICKLING FILTER



Pomona Terra-Cotta Co. Greensboro, No. Car.



NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.

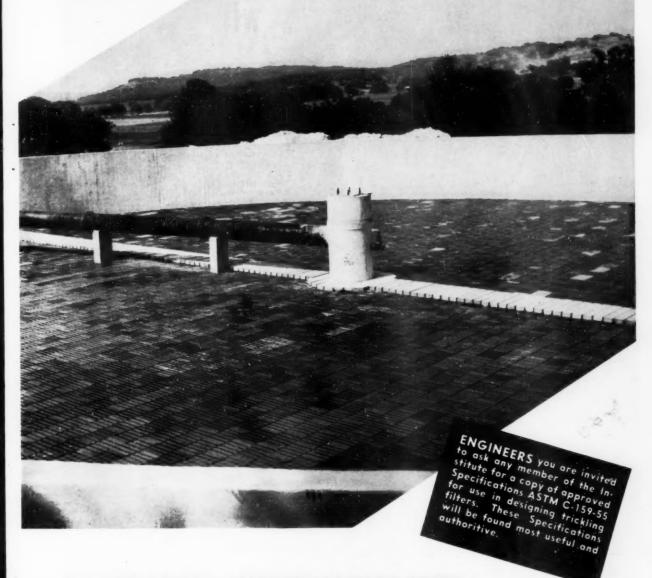


W. S. Dickey Clay Mfg. Co. Kansas City 6, Mo.



TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas

Kerrville, Texas, trickling filter, with TFFI vitrified clay underdrains. H.R.F. Helland, consulting engineer; Clay P. Carey, Brown-wood, Texas, contractor.
Distributors by Dorr.



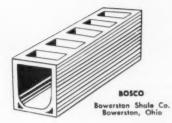
FLOOR INSTITUTE



ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



Cannelton Sewer Pipe Co. Cannelton, Ind.



PUBLIC WORKS for March, 1959



Ask the man who operates one

Second orders for the Holan Series 3700 Derrick are not too difficult. Once a utility uses it in the field, there's no question about the product.

Our specs tell you the 3700 has a 12,000-pound capacity and lifts 75-foot poles. Actually, it's been tested at 22,000 pounds and handles longer poles. It also hoists 5,000 pounds over the rear axle for bodyloading and has a 195° operating range. And you have plenty of power for forcing diggers into hard ground.

This derrick has three legs instead of two—an integral middle leg gives extra strength and has you ready for butt-pulling, body-loading, and extra-heavy lifts at a moment's notice.

If you want assurance before you buy, don't ask us. Ask the man who operates one.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona



WHICH GRIT COLLECTOR

will protect your system best?

LINK-BELT builds 7 types, can recommend the most efficient for your needs

Modern sewage treatment requires grit removal to reduce maintenance costs on mechanical equipment and eliminate operational difficulties. Link-Belt has been manufacturing the finest in grit collection equipment for over 25 years—offers types and designs for

any local conditions or requirements. For full details, contact your nearest Link-Belt office. Or write for your copy of Grit Collecting and Grit Washing Book 2571.



LINK BELT

SANITARY ENGINEERING EQUIPMENT



TYPE AB AERATED GRIT COLLECTORS are ideal for large installations, or at plants where it is desirable to combine pre-aeration and grit removal in the same tank. They consist of a Type B grit collector and porous tubes for admitting compressed air.



TYPE SW GRIT WASHER is a separate screw that washes and dewaters grit conveyed to it by pump, ejector, air lift or mechanical means. It can be counted on for long, dependable service in separating grit, water and putrescible matter.



STRAIGHTLINE GRIT COLLECTORS provide an easy method of collecting settled grit and inert solids without draining the grit chamber. These solids are dewatered and removed from the chamber by flight conveyors, screw conveyors, or buckets attached directly to the collectors. Shown is a Link-Belt Type B double-strand installation,

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World.



NEW MODEL DESIGNATION
CRAWLER EQUIPMENT

EIMCO 105

This is the basic **Tractor** available with **Dozer**, **Excavator** or **Excavator**-**Dozer** Attachments.

EIMCO115

New number designation for Eimco's rugged **Steel Mill Excavator**. Extra-Strong, for use in slag pits and other steel mill areas.

EIMCO 125

This is model number for the Front End Loader and Fork Lift ... fast, maneuverable, strong.

EIMCO 135

Specifiy this number for **Eimco's Steel Mill Front End Loader** . . .
specially engineered and proven in use in steel mills throughout the world!

Every Eimco Crawler Unit gives you greater maneuverability, greater production and work-output, greater economy . . . is engineered for service to your industry to save you time and maintenance costs.

Write for facts and qualified engineering assistance on Eimco . . . the MODERN Crawler Equipment.

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Salt Lake City, Utah, U.S.A.

Export Offices Eimco Building, 51 - 52 South Street, New York 5, N. Y.

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD



CIVIL ENGINEERING HANDBOOK

This newly published revision of this well known handbook presents a large body of essential theory, standards, practice and data for solving specific problems in civil engineering. Ten large sections cover modern advances in all areas. from city surveying and railway engineering standards, through hydraulic models and bridge trusses, to the design of cement mixtures and dams. The book gives rules, principles, working methods and engineering pointers and covers mechanics of materials, stresses in framed structures, steel design, highway and airport engineering, water supply, sewage disposal and other aspects of civil engineering. This fourth edition reflects many revisions and new and expanded material appears on photogrammetric surveying, interstate highway system requirements, soil classification, flow in pipes and channels, stresses in continuous beams and frames and welded steel construction. The Editor-in-Chief is Leonard C. Urquhart of Porter, Urquhart, McCreary & O'Brien Consulting Engineers. Copies of this 1174 page book are \$17.50 each and are available from McGraw-Hill Book Information Service, 327 W. 41st St., New York 36, N. Y.

THE PRACTICE OF SANITATION

In preparing the third edition of a text first appearing in 1951, Edward S. Hopkins and W. H. Schulze have added twenty-one pages revising the material on food and milk sanitation, public water supplies, rural and urban sewage disposal, stream pollution, housing, air pollution and industrial sanitation. There is a welcome revision in chapter sequence, with principles of hydrogen ion concentration no longer handled as a separate chapter and administration practices receiving considerably less emphasis. Much of the new material has been incorporated in the chapter on public water supplies, which now includes infor-





Cushioned for Comfort and Safety

Now the famous Saf-Pla, used for rubberizing playgrounds, has also been successfully adapted for surfacing tennis courts. Recreation Directors and School Executives who know about the safety, convenience and weather resistance of Saf-Pla will be interested in knowing that the tennis courts have all these advantages and more. The life of the court will be increased because Saf-Pla can be applied over any existing hard surface . . . and in most cases, even badly deteriorated ones. Tennis players will appreciate the surer footing of rubber on rubber, as as the attendant foot-ease brought about by this resilient surface. The uniform bounce plus the safety factor in the event of a fall are additional reasons why your tennis court should be surfaced with Saf-Pla.



Saf-Pla photographs taken at Agassiz Circle, Delaware Park, Buffalo, N. Y.

Send for Illustrated Literature
Bulletin No. 17

U. S. RUBBER RECLAIMING CO., INC.

mation on synthetic detergents and plastic pipe. Brief mention is made of radioisotope activity, and the section on fluoridation has been expanded. In over-all evaluation, more than 40 percent of the text is now devoted to various phases of water supply and treatment and sewage treatment and disposal.

As with previous editions the book has been developed as a guide in environmental sanitation for the training of health officers, sanitarians, nurses and students in sanitary engineering. Historical and bibliographical references are numerous and should aid those desiring to pursue more detailed information on a subject. The publisher is The Williams and Wilkins Co., Baltimore, Md. The price of the 487-page volume is \$8.

BASIC PROCEDURES OF SOIL SAMPLING

The three main sections in this Manual cover preliminary or general survey sampling, detailed explorations and logs and records. This book deals only with the securing of the sample, and not with its subsequent laboratory analysis. Methods and material covered are standard and in all cases have a degree of acceptance by soils engineering profession. Copies of the Manual are \$1 each and are available from Acker Drill Co., Inc., P. O. Box 830, Scranton 2, Penna.

STATISTICAL SUMMARY OF SEWAGE WORKS

This report compiled by John R. Thoman and Kenneth H. Jenkins of the Water Supply and Water Pollu-Control Program, Public Health Service, is a complete statistical analysis of community sewage collection and treatment practice in the United States. Data on individual systems, contained in the Public Health Service 1957 Inventory of Municipal and Industrial Waste Facilities, provide the basis for the summary. The statistical summary is principally tabular matter listing numbers and percentages of communities served by sewers and treatment plants of various types with the data analyzed from the standpoints of population served, types of treatment employed, and types of sewer systems (separate or combined). A further breakdown gives the data by population groups, by states, and by major drainage basins. Percentage of the population served by sewers and treatment plants is the subject of additional tables. The statistical data provided by the 1957 Inventory is compared with that from previous years, revealing the progress made and trends toward acceptance of modern waste treatment methods. The 40-page report is released under the title, "Statistical Summary of Sewage Works in the United States," Public Health Service Publication No. 609, and is available at a price of 20 cents from the U. S. Government Printing Office, Washington 25, D. C.

REGULATING AND CONTROLLING OPENINGS IN MUNICIPAL STREETS

An analysis of existing pavement cut ordinances in boroughs and townships of Allegheny County, Pa., and an interest on the part of many local officials for a recommended pavement cut ordinance prompted the Institute of Local Government, University of Pittsburgh, to prepare and publish this model ordinance. The purpose of this publication is to provide the means necessary to regulate the underground traffic. Copies are available from Institute of Local Government, Graduate School of Public and International Affairs, University of Pittsburgh, Pittsburgh, Pa.

A STUDY OF THE COMPARATIVE BEHAVIOR OF FRICTION PILES

The scope of this study was limited to the comparative behavior of various kinds of piles, exclusive of end bearing piles, with respect to their performance as individuals. No consideration was given to the group action of the piles or to the behavior of pile foundations as such. Only driven piles were included. The report was prepared by Ralph B. Peck of the University of Illinois. Copies are available from the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., at \$2.40 per copy.

COMMERCIAL STANDARD FOR POWER CRANES & SHOVELS

The Power Crane & Shovel Association, composed of 14 leading manufacturers of mobile power cranes and shovels, has completed recently, with the cooperation of the U. S. Dept. of Commerce, a new commercial standard for power cranes and shovels. Purpose of the standard is to establish uniform methods for the guidance of manufacturers, distributors and users in specifying power cranes and shovels and in presenting data concerning them. Copies may be obtained from the Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C., or from the Power Crane & Shovel Association, 75 West St., New York 6, N. Y., at 20¢.



NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C. 311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 1401 Peachtree St., N. E., Atlanta 9, Georgia







PAYS OFF FOR YOU AGAIN

Big new Cat No. 14

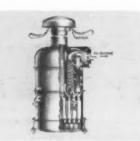
MOST VERSATILE BIG GRADER EVER DEVELOPED

In the new No. 14 Series B, Caterpillar brings you the first big grader that delivers high capacity both on the roughest and finest grading work. Another major achievement in Caterpillar's "Project Paydirt," it answers your need for a big unit that comes through dependably with higher, faster, lower-cost production on both control and power applications.

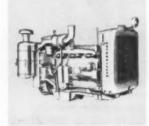
The first and only Turbocharged motor grader, the 150 HP No. 14 operates at the highest practical working speeds with either a 12-ft. or 14-ft. moldboard. It

is built with extra strength to match its power and weight. It incorporates the latest engineering advances developed by Caterpillar research.

Example: New design permits increased clearance between moldboard and circle for greater loads. You'll also find exclusive time-tested Caterpillar developments. Example: The oil clutch. Some of these features are listed here, but there are many more. They all pay off in this one fact: You can use the No. 14 profitably anywhere.



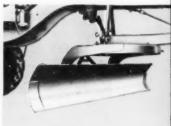
NEW DRY-TYPE AIR CLEANER: Removes 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes.



TURBOCHARGED CAT ENGINE: First and only Turbocharged engine in a grader. Engine provides high 18% torque rise for superior performance.



PRECO AUTOMATIC BLADE CONTROL: Another Caterpillar exclusive, optional on the No. 14. Maintains blade slope within 1/6 in. in 10 ft.



HIGH THROAT CLEARANCE: New design permits increased clearance between moldboard and circle for unexcelled rolling action.



FOR CONTROL APPLICATIONS like fine finishing, surface maintenance, light spreading and blading, the No. 14 pays off with maximum efficiency. With Preco Automatic Blade Control, it controls blade slope within 1/6 in. in 10 ft.—cuts fine grading time up to 50%1

Turbocharged Motor Grader

... WITH HIGH CAPACITY FOR EVERY APPLICATION!

As a result, you don't have to pick "spots" to make the No. 14 a sound investment. This modern, all-purpose big grader will earn its keep on every application with high capacity and low operating cost. But see for yourself. Get the complete facts from your Caterpillar Dealer. Just say when and where—he'll demonstrate.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

♣ PROJECT PAYDIRT: Caterpillar's multi-million-dollar research and development program — to meet the continuing challenge of the greatest construction era in history with the highest production earthmoving machines ever developed.

EXCLUSIVE OIL CLUTCH: Provides up to 2,000 hours' service without adjustment, equal to about 12 months' "adjustment-free" operation.

POWER STEERING AND POWER BRAKES: Provide fast, positive response and ease of operation that help operator maintain high production anywhere.

TUBELESS TIRES - 14.00-24 (10-PLY RATING): All tires mounted on wide 10-in. rims to stiffen tire side-walls and reduce tire "roll." Large tires on front end improve machine stability.

EXTRA STRENGTH FRAME: Heavy frame, drawbar and circle are ruggedly built to match engine power.

UNEQUALED VISIBILITY: An operator, while seated, has an unobstructed view of critical areas at the front wheels, blade toe and circle.

NEW TURBOCHARGED NO. 14

| Engine HP | (rate | d | at | sea | le | vel) | | ٠ | | | 150 |
|-------------|-------|----|-----|-----|----|------|---|-----|------|-----|--------|
| Weight | | | | | | | | ٠ | 2 | 9,2 | 80 lb. |
| Blade - sta | ındar | d | | | | | | | | | 12 ft. |
| Optiona | ıl . | | | | | | | | ٠ | | 14 ft. |
| Tires—all | arou | nd | | | | | | | | 14. | 00-24 |
| Travel spec | eds – | 6 | for | war | d, | | | | | | |
| 2 revers | e. | | | | | | 2 | 2.6 | to 2 | 1.6 | MPH |
| Turning ra | dius | | | | | | | | | | 36 ft. |

A COMPLETE MOTOR GRADER LINE!

With the addition of the No. 14, Caterpillar now affers a modern, heavy-duty motor grader for every purpose. Other units include the world-famous 115 HP, 23,000 lb. No. 12 and the 75 HP, 20,805 lb. No. 112. Like the No. 14, each is designed to do more work at lower cost with less down time than any unit in its class.

CATERPILLAR

DIESEL ENGINES · TRACTORS · MOTOR GRADERS
EARTHMOVING EQUIPMENT

BORN OF RESEARCH PROVED IN THE FIELD



36

safety can afford New Alcoa Aluminum Beam Guard Rail

Alcoa's new aluminum beam guard rail for highways combines maximum safety with modern appearance and minimum upkeep. Fabrication from high-strength aluminum alloys assures increased energy absorptive capacity.

Alclad aluminum provides permanent resistance to corrosion and means direct savings in maintenance costs. It resists the corrosive effects of road salts, industrial fumes and airborne grit. No painting—on or after installation—is necessary. Initial cost, only slightly higher than ordinary guard rail, is rapidly equalized by the savings in painting and other maintenance. Alcoa® Beam Cuard Rail is available with aluminum posts, too.

Now is the time to get the full story on Alcoa Beam Guard Rail, Lighting Standards, Highway Signs, Overhead Structures and Chain Link Fencing. To learn how they help stretch taxpayers' highway dollars, call your nearest Alcoa sales office or write: Aluminum Company of America, 1912–C Alcoa Building, Pittsburgh 19, Pennsylvania.

BRIDGE RAILINGS of Alcoa Aluminum deliver maximum return for tax dollars, because first cost is last cost. Lightweight aluminum is easier to handle and faster to erect. Corrosion-resistant Alcoa alloys never need maintenance; they end painting costs that commonly run to a dollar per lineal foot per year.





OVERHEAD SIGN STRUCTURES eliminate periodic maintenance and the accompanying traffic tie-ups when they're built of Alcoa Aluminum. Tubular truss designs and single-chord spans meet any requirement and their lightness permits faster erection with minimum man power and equipment.



Your Guide to the Best in Aluminum Value

For Exciting Drama Watch "Altea Theatre," Alternate Mondays, NBC-TV and "Alcoa Presents," Every Tuesday, ABC-TV

E quipment and

M aterials for your

PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

Water-Cooled Throw-Out Clutch on Cleveland Backfiller

31. Action photographs and a description of the Cleveland 190 backfiller are included in bulletin available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card.

Complete Specifications on Smith Hydrants



89. Smith frost-proof fire hydrants that conform to AWWA specifications with 4, 4½, 4½, 5 and 6-in, valve open-ings for water working pressures up to 150 lbs, and hydrants 150 lbs, and hydrants for intermediate and high pressure services up to 300 lbs, are covered in catalog from the A. P. Smith Mfg. Co., East Orange, N. J. Check the for municipalities.

Torque Converter and Its **Application to Shovel-Cranes**

104. "How to Get the Most Out of Shovel-Cranes With Torque Converters" is the title of the 16-page bulletin available from Link-Belt Speeder Corp., Cedar Rapids, Iowa. Cheek the reply card for this handbook.

Hydromat Asphalt Liners Manual

165. Hydromat applications, design factors, guide specifications for materials, reservoir lining and general engineering data are covered in 34-page catalog from W. R. Meadows, Inc., 2-18 Kimball St., Elgin, Ill. Check the reply card for this valuable catalog.

Clarifier and Oxidator® Mechanisms for Water and Sewage Treatment

112. Catalog SM-1005 describes the Eimo-Process Clarifiers and Oxidators[®] that cover a full range of tank sizes and load requirements and special units for unusual conditions in water, sewage and industrial waste treatment. Check the reply card or write Process Engineers, Inc., 420 Peninsular Ave., San Mateo, Calif., for your copy.

Black Top Maintenance and Construction Equipment Catalog

114. A highly informative catalog covering the field of road maintenance and construction equipment is available from Littleford Bros., Inc., 457 E. Pearl St., Cincinnati 2, Ohio. Check the reply card.

Controlling Plant and Animal Pests in Farm Ponds

123. Copper sulfate is used to control plant pests and aquatic plants in farm ponds. Check the reply card or write Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y., for complete data on the use of copper sulfate.

Protecting Water Lines Against Overpressures

126. Overpressures can be eliminated in water systems by the use of the Surge relief valve described in Bulletin W-2-A from the Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Check the reply card for complete engineering information, detailed drawings and suggested specifications.

Armco Bin-Type Retaining Walls

134. Technical and curve data, typical applications and various engineering problems on bin-type retaining walls are covered in 18-page catalog from Armoo Drainage & Metal Products, Inc., Middletown, Ohio. Check the reply card.

Data on Portable Hydraulic Earth Borer

138. Complete specifications on the Holan hydraulic earth borer are available from J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Check the reply card for literature.

Catalog on Gray Iron Castings for Highways and Municipalities

153. Large variety of construction castings including catch basins, catch basin inlets, manhole frames and covers, cast fron steps and the "Silent Knight" manhole are covered in 50 page catalog from Brillion Iron Works, Inc., Brillion, Wisc. Check the reply card.

Span-Saws, the Answer to Fast, **Efficient Control Joint Cutting**

168. Felker Span-Saws are available in 12 or 25-ft, cuts for highway and airfield control joint cutting. Check the reply card or write Felker Mfg. Co., Torrance, Calif., for literature.

Catalog on Tractor-Driven **Tailgate Spreader**

182. Highway Equipment spreader spreads in the echelon pattern for ice control and the blanket pattern for seal coating. For literature write Highway Equipment Co., Dept. H41 616D Avc. N. W., Cedar Rapids, Ia., or check the reply card.

Specifications on

Heavy-Duty Air-Cooled Engines

191. Models, dimensions and power curves of Wisconsin air-cooled engines are covered in catalog from Wisconsin Motor Corp., Milwaukee 46, Wisc. Check the reply card for full details.

Manual on

Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Catalog on Complete Crouse-Hinds Floodlight Line

229. This catalog has been designed so that you can easily select from it the proper floodlight for the job. Check the reply card or write Crouse-Hinds Co., Syracuse 1, N. Y., or check the reply card for data on all types of floodlights.

All-Purpose Construction Tractor With "Spot-Turn" Clutch Steering

231. "Spot-Turn" steering enables the Oliver crawler tractor to have a very short turning ra-dius. Complete specifications in literature from The Oliver Corp., Industrial Div., 19300 Euclid Ave., Cleveland 17, Ohio, or by checking the reply card.

Complete Catalog on **Traffic Control Equipment**

240. All types of controllers, PR system of coordinated traffic control, vehicle detectors, timers, we hicle counters and radar speed meters are covered in catalog available from Automatic Signal Div., Eastern Industries Inc., Norwalk, Conn. Check the reply card.

Design Catalog on I-Beam Lok Bridge Flooring

244. The three types of AmBridge steel flooring: 5-in, open I-Beam-Lok, 4½-in, and 3-in, concrete filled I-Beam-Lok and 2-in. Terpre concrete filled sidewalk flooring are covered in catalog from American Bridge Div., United States Steel, 525 Wm. Penn Place, Pittsburgh, Pa. Check the reply card for design drawings, engineering data, descriptions and specifications.

Monthly Time and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterillar Tractor Co., News Service, Peoria, III., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply eard for your copy.

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The Huber-Warco 5D-190 blades down a fill on Wisconsin's new Hudson-Eau Claire Road.

Gerke gives **5D-190** a tough assignment

Lawrence Gerke, a contractor in Merrill, Wisconsin, chose the 5D-190 for the grading work on his Hudson-Eau Claire Road contract. The 5D-190 with a 195 h.p. diesel engine, torque converter and power shift transmission was just the ticket for this rugged terrain.

Over one million yards of dirt, and 300,000 yards of rock had to be moved. There were eight major cuts with the maximum 115 feet, and five major fills with the biggest being 70 ft.

The 5D-190's assignment... to build and maintain the haul roads, cut all the ditches, and work on the slopes after the cuts and fills were completed. The unit will also spread the granular sub-base and grade the top soil.

"We needed a grader that could do a mansized job in keeping the haul roads clear and leveling off the fills," said Paul Potts, the grade foreman on the job. He continued, "That's a big order for one machine but the powerful 5D-190 is doing a good job. It's a very dependable grader and we're well pleased."

Let your Huber-Warco distributor show you what the features of the 5D-190 can mean to you on your jobs.

Huber-Warco on the job

There's one grader on the job handling all of the grading jobs, and it's the powerful, dependable Huber-Warco 5D-190.

Haul units move on schedule as the 5D-190 smooths out ruts and removes sharp rocks from the haul roads.



Huber-Warco Company

MARION, OHIO

NEW LISTINGS (Cont.)

Asphalt Plant Inspector's Manual

253. This manual has been prepared to assist highway engineers and inspectors in the supervision of asphalt paving plants to assure the production of an asphaltic mixture that will conform to exacting standards. Check the reply card or write The Asphalt Institute, Asphalt Institute, Building, Campus, University of Maryland, College Park, Md., today.

Austin-Western

Construction Equipment Catalog

260. Power graders, street sweepers, road rollers, crushing and screening plants and hydraulic cranes are covered in catalog from Austin-Western, Construction Equipment Div, Baldwin-Lima-Hamilton Corp., Aurora, Ill. Check the reply card.

Special Equipment for Allis-Chalmers Crawler Tractors and Motor Graders

279. Pictured and explained in catalog from Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wis., are attachments and accessories that Allis-Chalmers has available to increase the versatility and working capabilities of their tractors and graders. Check the reply card for full details.

Barber-Greene

Continuous Asphalt Plants

320. This catalog covers the Model 848-A asphalt plant and presents each typical plant setup and separately shows the details of each component. Check the reply card or write Barber-Greene, Aurora, Ill., for your copy.

Submersible Pumps for Water Supplies and Booster Systems

328. Selection tables, performance curves, construction details and the many features of Myers submersible pumps are covered in Catalog 140 available from The F. E. Myers & Bro. Co., 249 Orange St., Ashland, Ohio. Check the reply card.

Power Tamper for Granular Soil and Bituminous Surfacing Work

342. The Kelley Power Tamper is a self-propelled unit that is equivalent to a 10-ton roller for backfilling, road widening jobs and compacting around culverts and pipeline trenches. For complete specifications write Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Himman Ave., Buffalo 23, N. Y., or check the reply card.

Automatic Pump Control Valves

344. Wiring and control diagrams, piping layouts, head loss curves, general dimensions and general specifications of pump control valves are covered in Bulletin 106 available from Ross Valve Mfg. Co., Inc., P. O. Box 595, Troy, N. Y. Cheek the reply card.

Use The Reply Card

Concrete Admixtures and Joint Sealers

346. Retarding and accelerating densifiers for concrete and mortar, cratings for exposed aggregate concrete, non meltable mastic waterstops and quicksetting products are covered in 8-page bulletin available from Sika Chemical Corp., 29-49 Gregory Ave., Passaic, N. J. Check the reply card.

Descriptive and Performance Data on Sump and Sewage Pumps

351. Performance tables, selection charts, characteristic curves and architect's and engineer's specifications of Pacific sump and sewage pumps are included in complete catalog from Pacific Pumping Co., 9201 San Leandro St., Oakland 3, Calif., or by checking the reply card.

How to Get Peak Water Production From Your Well

355. Well easings are a vital part of peak water production from wells as well as hiring a competent well driller. Catalog B-15-B from Thompson Pipe & Steel Co., 3025 Larimer St., Denver 1, Colo., covers in detail all types of well casings and their installations. Check the reply card.

Reference Bulletin Showing Treatment and Correction for Masonry Construction

357. Maintenance problems of masonry construction are covered in this 20-page bulletin from Standard Dry Wall Products Inc., New Eagle, Pa. Check the reply card for this complete and concise bulletin.

Data on Eimco, the Modern Crawler Equipment

358. Front end loaders, dozers, and fork lifts are some of the attachments available for the Eimo tractor. Check the reply card or write The Eimo Corp., Salt Lake City, Utah, for facts and qualified engineering assistance.

Slurry-Seal Spreader For Surface Sealing

370. The new slurry-seal method with the Tarco spreader gives a thin, even application of asphalt-sand-water slurry and fills and seals cracks and makes skid-proof surfaces. Check the reply card or write Tarrant Mfg. Co., 28 Juniel Place, Saratoga Springs, N. Y., for complete details.

385-HP Engine For Standby Pumps and Generator Sets

372. International 385-bp compact heavy-duty 4-cycle, 6-cylinder engine is well illustrated in literature from International Construction Equipment, International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., Check the reply card for full specifications.

Electric Submersible Contractor Pumps

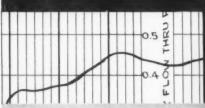
376. Capacity curves, specifications, accessories and list prices of Flygt electric submersible contractor pumps are covered in literature from Stanco Mfg. & Sales Inc., Construction Equipment, 1666 Ninth St., Santa Monica, Calif. Check the reply card.

Directly Readable Flow Charts for Measuring Sewage

380. Recorder gives graphic records of liquid flow directly readable in mgd or gpm over various sizes of Parshall flumes. Check the reply card or write, Leupold & Stevens Instruments, Inc., 4445 N. E. Glesan St., Portland 13, Ore., for Bulletin 24.

NOW

LOW-COST AUTOMATIC



...For Measuring Sewage, Industrial Waste and Other Flow





124 pages of technical data on recorder installations, plus a wealth of hydraulic tables and conversion tables. \$1 copy. (No COD's.)

Directly Readable Flow Charts

Obtain graphic records of liquid flow directly readable in million gallons per day or gallons per minute over various sizes of Parshall flumes. The same recorder can also be used with charts reading in feet and hundredths to record

reading in feet and hundredths to record head or surface fluctuations in lakes, streams, wells. Write for free Bulletin 24.

STEVENS TYPE F RECORDER

The planning and efficient operation

of any project which involves measurements of flowing liquids is based on flow data which can be obtained with STEVENS Recorders. These instruments are at work compiling data on hydroelectric and flood control projects and in water works, sewage disposal plants, irrigation and industrial installations in all parts of the world.

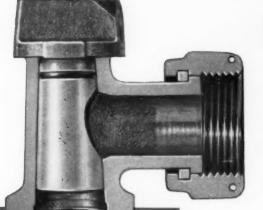
Experienced technical staff available to supply product information for liquid measurement installations. Write, giving description of project and scope of data desired.

LEUPOLD & STEVENS INSTRUMENTS, INC.

4445 N. E. GLISAN STREET • PORTLAND 13, OREGON specialists in hydrologic instruments for over half a century



New"O" ring seal positively prevents leakage ...in <u>all</u>

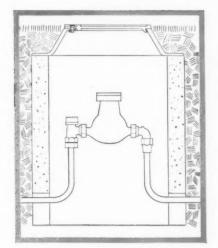


MUELLER

ANGLE METER STOPS

Now, all Mueller Angle Meter Stops are produced with an "O" ring seal at the top of the key. This new "O" ring, plus a generous ground key surface between the port and the top of the body, gives a dependable, positive double seal against leakage which may be caused by piping stresses on the stop body.

This improved design is typical of the intense attention to detail in research, design and engineering that becomes a part of every Mueller product produced for the water industry.



A typical setting for confined locations—a Mueller Angle Meter Stop and a Mueller Meter Coupling. No other fittings needed.

MUELLER CO. DECATUR. ILL.



Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario.

WATER WORKS

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Meter Features That Help Make Water Works Profitable

59. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American Water meters described in Bulletin No. 56 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Check the reply card.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Easily Cleaned Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Ilave you made a full investigation? Write Authracite Equipment Corp., Wilkes-Barre, Pa.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reuly card.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model RJ-Pressure or HCV-Vacuum Type diatomite sturry feed filter for swimming pools or Municipal Water Works from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves, Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

Now Every Municipality Can Own a Trencher

Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatue machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and littings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anuiston, Ala. Get this helpful data by checking reply card.

Lay Water Mains Faster With "Fluid-Tite" Couplings

184. Get permanent water-tight joints automatically with K & M "Fluid-Tite" couplings for K & M asbestos-ement pressure pipe, Full details on this faster installation and self-energizing couplings are available from Keasbey & Mattison Co., Ambler, Penna

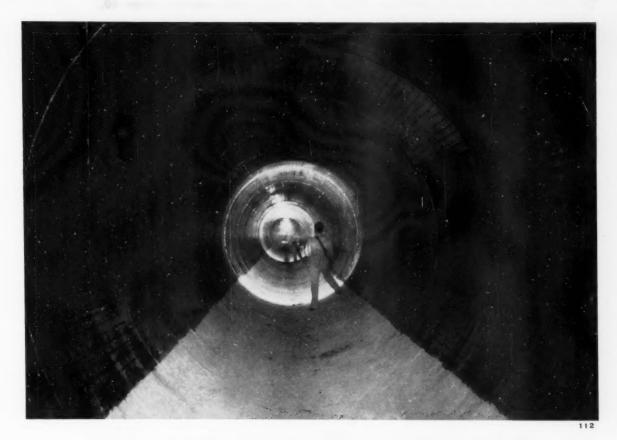
Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestessed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, httings and accessories for water works, sitration, sewage disposal and fire protection are ellustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Annison, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.





This Sewer will go a Long Way

Not only will this 9½-foot outfall sewer extend eight miles, but it will go a long way in years of trouble-free service. The engineers who designed it say that it will still be functioning perfectly in the year 2000.

Their confidence is based on wise choice of construction materials. Every joint of pipe, every foot of monolithic tunnel, every structure is built of reinforced concrete to obtain structural strength at low cost. Every surface above the low flow line is completely covered by a continuous membrane of T-Lock Amer-Plate®, the vinyl lining that is impervious to the corrosive action of oxidized hydrogen sulfide at any level of concentration.

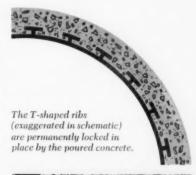
The engineers know that no one can accurately predict future rates of H_2S gas generation, so they have insured the ultimate life of the concrete by investing an extra 8 to 10% for T-Lock protection. They predict that this "extra" will spare their city the cost of a replacement sewer in about 20 years, and save the taxpayers millions of dollars!

Because of obvious and substantial savings such as this, millions of square feet of T-Lock are now in use in progressive municipalities from coast to coast. These include Los Angeles; Topeka; Wichita; Sioux Falls; Shreveport; Washington, D.C.; San Diego; Mansfield, Ohio; Huntington, W.Va.; Hutchinson, Kan.; and Orange County, Calif. T-Lock Amer-Plate is also on current specifications for many other municipalities. For complete list of users and specifiers, plus technical data and a typical specification, write:



Dept. BC 4809 Firestone Blvd. South Gate, California

Evanston, III. • Kenilworth, N. J. • Jacksonville, Fla. • Houston, Texas





There is no limitation on size or shape of structures which may be protected with T-Lock Amer-Plate.

Information on Service, Valve, Roadway and Meter Boxes

127. Literature on specifications covering:
"Buffalo" service, valve, roadway and meter
buses, and adjustable valve boxes for water and
gas has just been released from Buffalo Pipe
& Foundry Corp, Box 55-Station B, Buffalo 7,
N. Y. Check the reply card for your information on these valve boxes.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Catalog on

Dewatering Pumps

226. Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP7 from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

Water Lines Under Pavements Easily Installed

247. With a Trojan plpe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

Outline of Modern

Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment, Check the reply card or write The Permutit (O., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your course. for your copy.

Pipe Cutter for **Cutting Large Size Pipe**

254. An all-purpose pipe cutter that can cut pipe in or out of the ditch is described in a bulletin available from Ellis & Ford Mfg. Co., P. O. Box 308, Birmingham, Mich. Check the reply card for sizes and parts list.

Review of Digtomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Department, 612 So. Flower St., Los Angeles 17, Calif., for Bulletin BW-13 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co. 250 Elm St., Dedham, Mass. Size ranges are 14"-14" x4"-14" and 1". Check the reply card.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Inc., 375 Park Avenue, New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting with other types of pipe are included. Use the reply card for your request.

V-Notch Chlorinator

For Chlorine Flow Control

502. An 8-page catalog on the W & T Series A-721 chlorinator is available from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Chlorinator is adaptable to any type of chlorinator control and feed rate may be controlled manually or automatically.

Sealed Register Water Meter **Contains 15 Stock Parts**

445. A 20-page—Catalog No W-811, describing the Rockwell scaled register meter includes illustrations, drawings aspecifications and color photos. Check the reply card or write Municipal and Utilities Division, Rockwell Manufacturing Company, 400 N. Lexington Avenue, Pittaburgh 8, Pa., today for complete parts list with illustrations and specifications.

Floatless Liquid Level Controls

513. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

Use The Reply Card

Badger Read-o-Matic Register For Outside Water Meter Reading

536. The Read-o-Matic is simple to install and requires no outside power. Doorbell-type wire carries the pulse from generator in meter to the register on the outside of the building. Check the reply eard or write Badger Water Meters, 4545 West Brown Deer Road, Milwaukee 18, Wisc.

Bulletin Helps Specify A.W.W.A., Gate Valves

A.W.W.A., Gate Valves

547. Double disc gate valves in 2" to 60" sizes are fully described in a 16-page bulletin which gives details on valve parts, design, materials, application of the "O" Ring Seal, operation and operating devices, directions for ordering valves and parts, dimensions of all sizes, and descriptions of eleven different methods for end connections. Valves for horizontal operation, square bottom valves, many types of gearing and gear cases, and a complete listing of special controls available are included. Get Bulletin A from Rensselaer Valve Co., Troy, N. Y. by checking the reply eard.



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rugged as the men who use them

IGL00 leads in water cooler sales because it's stronger, lasts longer. IGLOO will keep more men on the job more of the time. When you order water coolers, specify IGLOO. Available in 2, 3, 5, 10 and 15 gallon sizes.





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HERSEY

Compound Meters

have never been equaled for the accurate registration of all rates of flow, and for many years have maintained long and consistent records for performance at a minimum of cost.

All Bronze Case
Sizes 2"- 3"- 4"- 6"
Inclusive
as illustrated
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Iron Case Meters
(not shown here)
in sizes 8"-10"



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SAN FRANCISCO - LOS ANGELES

- ATLANTA - DALLAS - CHICAGO

"You can't buy a better Water Meter than HERSEY."

Modern Elevated Water Tanks

566. A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheriold, is available from the Chicage Bridge & Iron Co., 332 South Michigan Ave., Chicage 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered.

Filter Sands and Under Drain Gravels

814. Filter sands and gravels for municipal water plants are described in literature available from Eau Claire Sand & Gravel Co., Eau Claire, Wis. Check the reply card for data on sizes available, silica content and content of magnesium, calcium carbonates and iron oxides.

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Plug Valve Lubricant Catalog

459. A 16-page illustrated catalog gives lubricant recommendations for nearly 4000 service conditions for which lubricated plug valves can be used. It also shows lubricated plug valves accessories, fittings and lubricant guns. Write Homestead Valve Mfg. Co., Coraopolis, Pa., or check the reply card.

Cast Iron Pipe That Bends Under Stress

483. This cast iron pipe from 2 through 48 ins. has as advantages extra strength, high resistance to impact, bendability, greater reliability, ample wall thickness and adaptability. Check the reply card or write American Cast Iron Pipe Co., Birmingham, Ala., for full specifications.

Manual on Valves, Fire Hydrants and Accessories

670. Complete line of Iowa valves and bydrants are covered in this manual from Iowa Valve Co., Oskaloosa, Iowa. All equipment meets AWWA specifications.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois, or by circling the reply card.

Mueller Drilling, Tapping and Inserting Machine

696. The Mueller B-100 double pressure chamber tapping machine makes faster taps, assures pressure tight connections and can be used by hand or with power, Check the reply card or write Mueller Co., Decatur, III.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

28. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P. W., Adams, Mass. Check the reply card.

Engineering Data on Screening Equipment

77. Water, sewage and industrial waste screening equipment is fully described in a 24-page book. No. 2587. offered by Link-Belt Co., Colmar, Pa. Complete data for the engineer and tables to determine the proper size unit for handling various capacities are included. This valuable comprehensive booklet may be obtained by checking the reply card.

Automatic Engine Central Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13. III. Camplete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Flush Kleen" sewage pumpa are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.



WRITE TODAY for a copy bulletin 2350R-1. It's brand new, contains much helpful information on designing for efficient handling practices.

Proper bucket or grapple headroom allowances mean more efficient incinerator operation

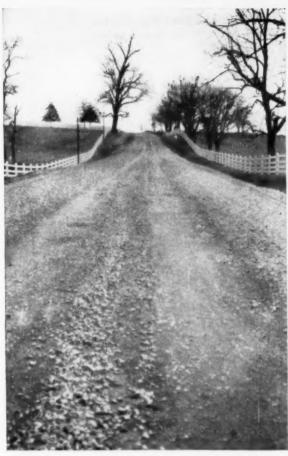
Planning and making allowances for necessary headroom over the hoppers insures better operation of your incinerator. Loose refuse hanging below the bucket or grapple will not be knocked off, with the resulting necessity of manual clean-up time.

Blaw-Knox engineers are available to assist you in planning, selecting and applying Clamshell Buckets and Tine Type Grapples especially developed and built for incinerator service. They'll be glad to lend their experience and guidance toward the best solution of your incinerator handling problems.

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division Pittsburgh 38, Pennsylvania





Non-treated open surface before spring maintenance.

Note loose aggregate.



Another view of the same roadway after consolidation with Columbia Calcium Chloride.

HOW TO GET BETTER ROADS THIS SPRING AT LESS COST... WITH COLUMBIA CALCIUM CHLORIDE

Right now is the time to put your spring road maintenance and stabilization program into effect.

- Check soil-aggregate roads for proper balance of aggregate and binder. Add where necessary.
- Reshape to proper crown while sufficient moisture is still in the ground.
- 3. Treat with Columbia Calcium Chloride.

Economical Columbia Calcium Chloride holds soil moisture in your roads, makes firm, compact, smooth surfaces. Roads are less apt to wash out, dry out, or develop potholes.

Maintenance costs are lower with Columbia Calcium Chloride treated surfaces. Annual gravel loss due to abrasive action of traffic is cut up to 75%. Only three or four bladings per year are usually needed—even on heavily traveled roads. Just one or two "sweetening" applications of Columbia Calcium Chloride are necessary to maintain firm, smooth, dustless wearing surfaces through summer and early fall.

We will be happy to send you the latest information on new economies in road treatment. Contact your closest Columbia Calcium Chloride supplier or write directly to the nearest Columbia-Southern District Office or to our Pittsburgh address.

High Test Flake (94-97% CaC1₂) is available as a companion product to Regular Flake (77-80% CaC1₂). Each 80-lb. bag of High Test does the job of a 100-lb. bag of Regular.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company • One Gateway Center, Pittsburgh 22, Pennsylvania

DISTRICT OFFICES: Cincinnati • Charlotte • Chicago • Cleveland • Boston • New York • St. Louis • Minneapolis • New Orleans

Dallas • Houston • Pittsburgh • Philadelphia • San Francisco IN CANADA: Standard Chemical Limited

Manual on Instrument Accessories and Supplies

96. The 60-page loose-leaf book, Catalog 500, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies. It is divided into 5 sections: Mechanical; pneumatic; electric-electronic, general, and tools and service. Check the reply card or write The Foxboro Co., Foxboro, Mass., for your copy.

Buckets and Grapples For Incinerator Service

110. Bulletin provides comprehensive information on the 5 sizes of 2-line, lever arm, clamshell-type buckets; standard 2-line, tine-type grapples; equalizer arrangements and certain incinerator buckets for single drum hoists. Check the reuly card or write Blaw-Knox Co., 300 Sixth Ave., Pittsburgh, Pa., today.

Up-Sewer Treatment Controls Odors

129. Controlling sulfide production and the activity of odor-producing organisms by applying Cloroben at selected manholes, and at sewage treatment plants is described in a folder for your file cabinet. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearney, N. J. or check the reply card.

Incinerator Maintenance

Can Be Cut!

159. There are no joints in a Plibrico lining and the lining has a positive anchorage system holding it securely in place. The stoker provides automatic ash discharge and works as a single unit. For complete details on cutting incinerator maintenance write Plibrico Incinerators, 1800 Kingsbury St., Chicago 14, Ill.

Select Flowmeters

273. Technical Bulletin 91-119 gives criteria for choosing the type of flowmeter to be used in measuring a given fluid or liquid. Write Fischer & Porter, 547 Jacksonville Road, Hatboro, Pa., or check the reply card for advantages and limitations of the basic types available.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-fasting acid-resistant vinyl sheet lining for con-crete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for il-lustrated folder.

Blower Selection Data Aids Sewage Plant Design

144. Characteristic curves for blower op-eration with constant-speed, multi-speed and variable speed motors; details of several types of blowers; data on accessories; and a discus-sion of advantages of positive displacement ro-tary blowers are provided in Bulletin RB 154 of Roots-Connersville Blower Div., Connersville, Ind

Use The Reply Card

A Short Course

In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Migs. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type, gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Automatic Controls for

Water and Sewage Treatment

354. Controls of flow, temperature or level, using pneumatic or electronic controllers are covered in bulletin from Bailey Meter Co., Water & Waste Treatment Div., 1055 Ivanhoe Road, Cleveland 10, O.

"Hardrock Smitty" says:

F & E Constant-Flo

Incinerator Stoker

406. Drawings, photographs and text describing the new design of this incinerator stoker for Constant-Flo operation are covered in Catalog No. 1703 from Flynn and Emrich Co., 301 Holliday St., Baltimore 2, Md. Check the reply card.

Walking Beam

Flocculation Mechanism

416. Diagrams and photographs illustrating the application and installation of the Walking-Beam Flocer in sedimentation basins and sample specifications are included to aid the designing engineer in 16-page publication. Write the Stuart Corp., 516 N. Charles St., Baltimore 1, Md., or check the reply card.

Portable, Standby

Or Continuous Power

449. Generators and power plants for emergency, portable continuous power are described fully in literature available from Katolight Corporation, Box 89-107, Mankato, Minnesota. Information on motor generator sets, high frequency changers and independent generators up to 400 K. W. is included.

Torque-Flow Sewage Pump

For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemoo torque-flow sewage pump and covers typical installation set-value. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

Gas and Gasoline

Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

...

THE SMITH 125 AIR COMPRESSOR CAN'T BE BEAT FOR RUGGED DEPENDABILITY.

Built to stand up under all conditions, the Smith 125 Compressor costs less to buy and less to operate. Easy maintenance, simple compact design means more air for less money. 95% of

all moving parts are available from the nearest industrial engine dealer. Besides the 125 there are 45 cfm and 75 cfm models both portable and stationary.

Write us for complete information and the name of your nearest dealer.

Ask your dealer for an "on the job" demonstration.

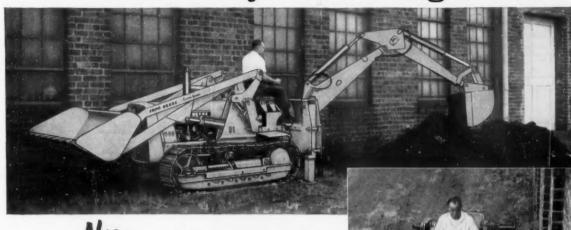


GORDON SMITH & COMPANY, INC., Bowling Green, Ky.

48

PUBLIC WORKS for March, 1959

Here's REACH and POWER to Tackle Any Trenching Job...



The New John Deere 5-Position Backhoe

R eaching out over 20 feet at ground level, digging below 13 feet, dumping at a height of 11 feet, working closely to buildings or fences—the new John Deere 51 Backhoe gives you the kind of working performance you need to speed work and cut costs. What's more, there's plenty of leverage and husky hydraulic power for digging in hard or frozen soil.

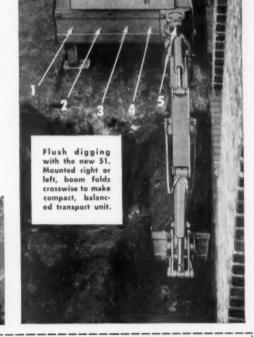
And it's responsive, easily controlled digging power—just two control levers to operate.

FAST CHANGEOVER

Changing the mounting position of the boom and rotary cylinder is amazingly easy. One man with a wrench makes the switch to any of five spots on the mounting pad in 15 minutes! For the complete story, see your John Deere industrial

dealer. Send coupon for free literature.







Completely Engineered for Industry

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Moline, III. Dept. D-66-R

Please send me your latest literature on the John Deere Crawler Tractors and Equipment, and information on the John Deere Credit Plan.

Jame_____

Firm_____

City_____State____

Catalog on Steel Grating

445. New ideas in flooring, walkways, staff treads, platforms and shelving are covered in Catalog 2527 available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Reinforced Concrete Pipe For Culverts and Sewers

472. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, III. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Full Line of

Sewer Cleaning Equipment

481. Everything for rodding sewers from
hand operated equipment to the fully mechanized
SeweRodeR. Tools for all types of stoppages are
operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of
Bucket Machines is offered, All equipment is described in 48-page Catalog 55-A. Flexible, Inc.,
3786 Durango Ave., Los Angeles 34, Calif.

STREETS AND HIGHWAYS

How to Prepare and Maintain Roadways With Calcium Chloride

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesine Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided. Check the handy reply card.

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card, American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.

Tractor Loader Can Be Converted Into Eight Different Machines

38. Multiple-purpose tractor loader can be converted to a street sweeper, backhoe, fork lift, angle dozer, crase and rotary broom in a short time. Check the reply card or write Massey-Ferguson Industrial Div., 1009 South West St., Wichita 13N, Kans., for well illustrated catalog.

Use The Reply Card

How to Get Better Concrete Construction

93. A report on the use of "Pozzolith" as a means of increasing the strength and durability and reducing the permeability of concrete structures, while reducing costs at the same time, is presented by Master Builders Co., Cleveland 3, Ohio. Check the reply card today.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Chip Dollars from Your Overhead With Fitchburg Chippers

160. Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. PW, Fitchburg, Mass.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and handpropelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Concrete Pavement

171. Details of design and principles of concrete pavement construction are presented in a 78-page manual published by the Portland Cement Assn., 33 W. Grand Ave., Chicago 10, III. Data from many sources is summarized in convenient form to help design and construction engineers. Check the coupon for your copy.

Sand and Cinder Spreaders For Streets and Highways

175. PTO with mechanical or hydraulic operation and auxiliary engine with mechanical or hydraulic operation are the choice of drives on these sand and cinder spreaders. Check the reply card or write Baughman Mig. Co., 152 Shipman Road, Jerseyville, Ill., for complete catalog.

Complete Line of Wheel Tractors in 6 Power Sizes

179. A 16-page catalog CR-1374-H, that describes the 6 IHC wheel tractors from 12 to 72.5 hp. is available from the Consumer Relations Dept., International Harvester Co., 180 N, Michigan Ave., Chicago I, Ili. Special features and specifications for each of these 6 tractors, and a listing of all attachments available.



THE NAME GRANGEBURG AND THE SILVER BAND ARE REGISTERED TRADE-MARKS OF THE GRANGEBURG MANUFACTURING CO.

Over 300 million feet in use coast to coast!

The test of time has proved the high quality of Orangeburg *Root-Proof* Pipe and Fittings for house sewer lines, downspout run-offs and other underground, non-pressure uses.

Orangeburg's Taperweld Joints seal root-proof and watertight. No leakage, no infiltration. And because it's made of a strong, tough non-metallic material, Orangeburg does not rust. Alternate freezing and thawing...acids and alkalies found in ground water and sewage do not affect it.

All these qualities plus speed, ease and economy of installation have

gained for Orangeburg a growing acceptance among leading approving authorities, architects, engineers, builders and plumbers. Today, over 300 million feet of Orangeburg are in service from Maine to California.

The Silver Band* identifies genuine Orangeburg: Root-Proof Pipe for sewer lines; Perforated Pipe for foundation drains, septic tank disposal fields. Orangeburg exceeds requirements Federal Spec. SS-P-356 and Commercial Standard CS 116-54. Write Dept. PW-39 for Engineer's independent report.

ORANGEBURG MANUFACTURING CO. Orangeburg, N.Y. Newark, Calif.

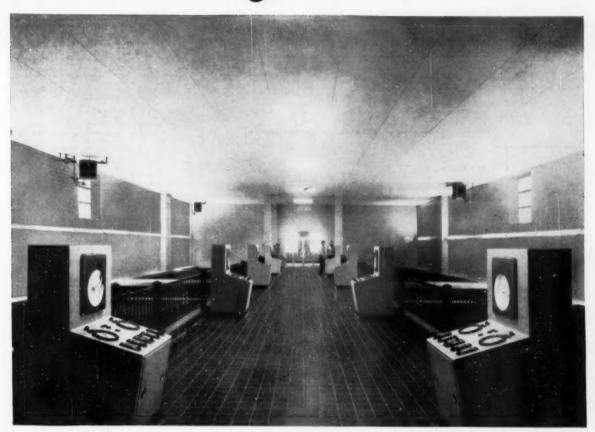
A Division of The Flintkote Company, Manufacturers of America's Broadest Line of Building Products

GENUINE ORANGEBURGRoot-Proof Pipe and Fittings

58,000 reasons why Dubuque, Iowa depends on

Bailey!

.... Protecting the health of 58,000 Iowans requires the filtering of up to 18,000,000 gallons of water per day. These ten Bailey Filter Operating Consoles control and record the rapid sand filtering process.



Engineers: Consoer, Townsend & Associates Contractor: E. W. Bacharach, Inc.

In the race to supply the ever-increasing demands of industrial expansion and population growth, more and more cities are turning to newer, more economical and more scientific methods of water handling.

In many of these new or modernized treatment plants you'll find Bailey Instrument and Control Systems. Because Bailey can furnish *complete* control systems made up of *standardized* components . . . that not only do a better job, but can easily and economically be expanded to meet future needs.

Engineers, water superintendents and city officials themselves will tell you that Bailey electric and pneumatic telemetering and control systems are outstandingly reliable and economical, attractive and easy to maintain.

Consult a qualified Bailey Engineer about your water handling requirements. w-3

WATER & WASTE TREATMENT DIVISION

BAILEY METER COMPANY

1055 IVANHOE ROAD . CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal



Modern Compaction Methods and Equipment

200. This 52-page Manual covers modern day compaction methods and equipment, rubber-tire rolling, compaction of asphalt mixes, aspects of vibratory compaction, stage compaction on cohesive soils and compaction of asphaltic concrete surfaces. Check the reply card or write Road Machinery Div., Bros Inc., 1057 Tenth Ave., S. E., Minneapolis 14, Minn., for your copy.

Complete Facts on New Extra Heavy Duty Trucks

272. Bulletins covering conventional and tilt cab trucks and tandem axle models are available from Ford Div. of Ford Motor Co., P. O. Box 658, Dearborn, Mich. Check the reply card.

The Principles of Compaction by Vibration

288. Compaction by Violations
288. Compaction specifications that can't be
met with ordinary compactors are no problem to
the new Essick vibrating rollers. Complete
descriptive literature explaining the principles
of compaction by vibration and the Essick vibtrating roller is available from Essick Mig. Co.,
1950 Sante Fe Ave., Los Angeles, Calif.

How To Build Stabilized **Heavy Traffic Pavements**

300. A 16-page booklet published by Seaman-Andwall Copp., 13050 West Blue Mound Rd., Elm Grove, Wisc., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer.

Illustrated Specifications on Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asolundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 505 York Road, Jenkintown, Pa., or use the handy reply card.

Manual on the Use of Calcium Chloride

301. This manual presents the physical and chemical properties of the new pellet-type calcium chloride and its water solutions. Also, gives complete data on shipment, handling and storage. Check the reply card or write The Dow Chemical Co., Midland, Mich., for your copy.

Hough Payloaders for City, County and State Operations

323. Hough Payloader Model H-90 can be used on many road construction and maintenance jobs, and its operation, specifications and attachments available are covered in literature from The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, III.

Manual on Steel and Wire for Road Building

337. Design data on wire fabric for conerete pavements, joint data, guardrail design
standards, steel and wire for concrete pipe and
reinforced bituminous concrete design are some
of the sections covered. Check the reply card
or write American Steel & Wire Div. of
United States Steel Corp., Cleveland 13, Ohio,
for this valuable manual.

Hand Operated Soil Sampling Kit

366. Bulletin 26-R describes the Acker soil sampling kit that contains 12 different soil sampling tools packed in a handy steel case. Check the reply card or write to Acker Drill Co., Inc., P.O. Box 830, Scranton 2, Pa., for data on tools that are designed to take soil samples from practically any material.

Motor Graders With Torque Converter and Power Shift Transmission

430. Complete operation data and specifica-tions of Huber-Warco motor graders are covered in Bulletin No, HWG521 available by checking the reply card or by writing Huber-Warco Co., Marion, Ohio,

Vacuum Cleaner and Leaf Collector For Cleaner Streets

595. A unit is now available that can be mounted on a right-band drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y., or can be obtained by checking the reply card.

Construction Methods for Salt Stabilized Roads

609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 110 Nr. Wacker Drive., Chicago 6, III. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

Helpful Data on Distributors for Bituminous Materials

611. Pressure distributors featuring uniform pressure and temperature, accurate displacement pumping, convenient operation are described in literature of Standard Steel Works, North Kansas City, Mo.

Better Roads With Sterling Rock Salt

650. This manual describes the simplified 7-step method of road improvement with rock salt. This type of salt stabilization is designed for cities, townships and counties. Check the reply card or write Highway Sales Dept., International Salt Co., Scranton, Pa., today.

Manual on Highway Railings For Bridges and Roadways

640. This manual covers design suggestions, components, specifications for design and construction and the advantages of Aleoa aluminum alloy highway railings. Check the reply card or write Aluminum Company of America, Alcoa Bldg., Pittsburgh 19, Pa., for this valuable

Not the Lightest Weight but the HEAVIEST DUTY



Tapered roller bearings at both ends of crankshaft . . . preventing bearing failure.



Positive lubrication . . . forged connecting rods with heavy-duty bearing.



Heavy-duty 12-volt combination startergenerator . . . available for models 3 to 9.2 hp.



• The most important "mower ingredient" is the engine that drives it . . . which is why it pays to specify "Wisconsin," unmatched in heavy-duty features in the mower engine field. Put a hefty Wisconsin Engine-powered mower to work and you get more workhours out of the manhours you pay for. There's far less downtime due to "engine problems." Write for bulletin S-237 describing all Wis-

More than 2,000 service stations...one or more in your area.



available on all models.



consin Engines. Electric starting equipment

WISCONSIN MOTOR CORPORATION

MILWAUKEE 46, WISCONSIN

World's Largest Builders of Heavy-Duty Air-Cooled Engines

In KNOXVILLE, TENNESSEE S



TYLOX Rubber GASKETS. REXON Rubber GASKETS. and REXON PIPE COATING





PREVENT JOINT LEAKS, WHIP ACID ATTACK AND SPEED PIPE LAYING ON STORM-SANITARY SEWER PROJECT

Engineers and city officials went "Hamilton Kent" all the way. in the matter of selecting leak-proof pipe joints and acid-resistant pipe coating to protect Knoxville's new Riverfront-Willow Avenue sewerage and drainage project . . .

Heavy duty precision TYLOX Gaskets coupled the large diameter T & G concrete storm lines. REXON "K" Light Duty Gaskets jointed the smaller diameter B & S sewer lines. and tough, non-deteriorating REXON No. 2 Pipe Coating put a protective covering inside all lines that would serve nearby stockyards, butchering plants and other industrial installations.

In specifying Hamilton Kent TYLOX and REXON rubber Gaskets, and REXON Pipe Coating, engineers and city officials not only provided to the utmost for the safety and long life of the system, but made possible substantial savings in construction costs . . . Both TYLOX and REXON Gaskets are quickly assembled to pipe, and permit fast assembly of the line. Their flexible, compression seal compensates for pipe angularities, allows wet trench coupling, and immediate backfilling.

WRITE FOR BROCHURES describing and illustrating use of Hamilton Kent TYLOX and REXON Gaskets and REXON Pipe Coating. Specify these products to protect your pipe projects from leakage and acid



PROJECT: For City of Knoxville, Tenn., Riverfront-Willow Ave. storm and sanitary sewers.

> ENGINEERS: H. R. Neal, City Engineer, and Roy I. Gentry, Service Director.

> CONTRACTORS: Division A-Harrison Construction Company, Alcoa, Tenn. Division B-Blont Brothers Construction Company, Montgomery, Ala.

> PIPE: T & G and B & S Concrete Pipe, manufactured by Sherman Concrete Pipe Company, Knoxville, Tenn.

HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

427 West Grant Street

Orchard 3-9555

STREET LIGHTING AND TRAFFIC CONTROL

Residential Street Lighting

228. A new 16-page bulletin on residential street lighting is now available from the General Electric Co., Schenectady 5, N. Y. Well illustrated, the bulletin, designated GEA-6316, explains how good lighting benefits a residential community and provides information on how to plan modern residential lighting installations.

New Reflectorized Sign Faces Refurbish Old Traffic Signs

292. Get complete details on new "E2. On" traffic sign faces ready for immediate shipment. Reflectorized faces cost about one half as much as new signs and are easily attached to existing traffic signs. Grace Sign & Mfg. Co., St. Louis 18, Mo.

3M Letters for Large Reflectorized Signs

374. "3M Signal" letters are made with "Scotchlitte" reflective sheeting encapsulated in acrylic plastic and are used on large reflectorized signs. Check the reply card or write Minnesota Mining and Mig. Co., St. Paul 6, Minn., for full details.

Manual on All

Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans., for your copy.

Practical

Outdoor Lighting

489. P & K luminaires and standards for outdoor lighting provide good lighting and

complement the architecture and design. Check the reply card or write Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., for models and

Street Lighting Poles for Streets and Highways

443. Standard designs, assembly details, suggested pole sizes, base construction details and bracket arm details are some of the details covered in this 22-page catalog. Check the reply card or write The Union Metal Mfg. Co., Canton, Ohio, for Catalog No. 78-A on street lighting poles of modern designs for all streets and highways.

REFUSE COLLECTION AND DISPOSAL

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get fuil details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the bandy reply card.

Refuse and

Garbage Packer Bodies

241. Ranging in capacity from 12 to 24 cu, yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

Information on the Hydepak Refuse Packer

437. The Hydepak refuse packer is designed so that a lighter more economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd. capacities. For complete specifications write Hydepak Division, Hobbs Trailers, 609 No. Main, Fort Worth, Tex., or check the reply card.

WEED AND DUST CONTROL

Investigate "Tifa" For Insect Control

47. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use reply card for full data on public health programs. Products Div., Todd Shipyards Corp., Columbia & Halleck Sts., Brooklyn 31, N. Y., Greens Bayou, Houston 15.

Weeds Controlled by Using Simazine 50W

278. General weed control is accomplished by using Simazine 50W and water. For full information on this new pre-emergence herbicide and how to use it write Geigy Agricultural Chemicals, P. O. Box 4.30, Yonkers, New York.

RECREATION

Rubberized Playground Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the resly card or write to U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y.

TRUCO[®] DOES IT AGAIN!!! Standard Truco Portable Diamond Drilling Machine plus 15' pipe becomes a "special" and handles big sewer job easily

JOB: Drill concrete sewer walls for test cores 6" dia. x 24" to 30" deep to be used in determining the thickness of the concrete. Sewer diameter was 11' to 15' and cores were taken every 1000 feet for a total of 44 cores.

JOB SITE: McNichols Road Relief Sewer, Detroit, Michigan.

DRILLING CONTRACTOR: Fattore Garavaglia Company, Detroit.

TOOLS: Truco Heavy Duty Model E Portable Drilling Machine with $4\frac{1}{2}$ H.P. air motor at 300 rpm. Truco Swivel Diamond Bit $6\frac{1}{4}$ " O.D.

OPERATION: The large diameter of the sewer necessitated the Truco machine being mounted on a 4" O.D. sectional pipe which acted as a column and enabled the machine to be braced against the opposite side of the sewer and thus provide rigidity for operation and leverage for drilling. Cores were taken at various angles and the equipment was readily moved from one location to another. No problems were encountered and full size, complete cores were easily obtained. Drilling rate was under one inch per minute. All 44 cores were obtained with a single Truco diamond bit.

Truco equipment is constantly delivering spectacular proof of superiority over other drilling equipment and often saves its cost in a single job. Truco equipment drills at any angle "Around the Clock." Write for literature and name of your distributor.



TRUCO MASONRY DRILLING DIVISION

WHEEL TRUEING TOOL CO. 74-3200 W. Davison Avenue Detroit 38, Michigan

PUBLIC WORKS for March, 1959



2-yd Loader Averages 2,700 yd Per Day for 5 Months on 2½-Million-yd Borrow Job

JOB: Relocation of Route 5 from Longmeadow, Massachusetts, to state line of Connecticut. 2½ million yards of borrow. Started last summer.

REPORT: — "Everyone in the area, it seems, who owns a shovel and a couple of trucks, is hauling on this job," says an on-the-spot reporter.

"The center of attraction, though, is the 2-yd TL-20 TRACTOLOADER* owned by Enfield Road Construction Company, Enfield, Connecticut. It sure is building a reputation for itself.

"It fills a 12-yd truck every $3\frac{1}{2}$ minutes. Averages 2,700 yd in a 10-hour day. It can be, and has been, pushed to 3,000 yd."

One of the reasons for this fast loading is Tractomotive's *exclusive* ONE-LEVER control of speed and direction. Operator goes into and out of any forward or reverse gear while moving—always works at highest possible speed.

Some of the other reasons for the TL-20's outstanding performance include: LONGER REACH — you dump loads right into center of high truck bodies. GREATER STABILITY — more operating comfort, less spillage. STRONG, PIN-CONNECTED AXLES — no rolling and shifting under load.

See how the TL-20 can increase your production. Your ALLIS-CHALMERS dealer will be glad to show you.

*TRACTOLOADER is a registered Tractomotive trademark.

ALL TRACTOMOTIVE EQUIPMENT IS SOLD AND SERVICED BY YOUR ALLIS-CHALMERS DEALER

TRACTO-

a sure sign of modern design

TRACTOMOTIVE

TRACTOMOTIVE CORPORATION

DEERFIELD, ILLINOIS

TRACTOLOADERS

TRACTOSHOVELS

TRACTORIPPERS

TRACTOHOES

TRACTOSIDEBOOMS



CONSTRUCTION EQUIPMENT AND MATERIALS

For Fast, Smooth Pipe Cuts

48. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

Four Wheel Drive 11/4 vd.

Front End Loader

115. The Trojan 1½ yd. loader for heavy-duty bulk materials handling is covered in bul-letin available from Contractors Machinery Div., The Yale & Towne Mfg. Co., Batavia, N. Y. Check the reply card.

Ford Tractors Equipped With Loader of 2500 lb. Lift

162. New Ford tractors give you multi-job versatility with a full line of attachments. Check the reply card or write Tractor and Implement Div., Ford Motor Co., Birmingham, Mich, for data on this rugged and powerful tractor.

A Fully Rotary

Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oli-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

Drilling Machine

For Concrete

221. The Truco diamond drilling machine is described in literature available from Truco Masonry Drilling Div., Wheel Trueing Tool Co., 15-3200 W. Davison Ave., Detroit 38, Mich. Unit will cut reinforced or plain concrete.

Manual on the Use and **Application of Compactors**

261. A Manual covering the various types of compaction equipment in use today and including rollers and vibratory compactors is available from The Galion Iron Works & Mfg. Co., Galion, O. Check the reply card for details on the problems encountered in the efficient compaction of various materials, and the correct use of compaction equipment available.

Eaton 2-Speed Axles For Your Trucks

244. Truck axles that provide easy shift, supply positive lubrication and have a self-contained air brake are available from Eaton Mfg. Co. For complete information on these rugged axles check the reply card or write Eaton Mfg. Co., Cleveland, Ohio.

Tractors and Equipment for Municipal Use

407. Specification sheets for the John Deere crawler and utility wheel tractors; also equipment for loading, dozing, mowing, sweeping and many other operations, John Deere, Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

4-Wheel Drive Tractor Loaders

434. A 16-page Catalog, No. 1033-5-57, describing the "Tracto-Loader Line" of front end wheel loaders is available from Tracto-motive Corp., Deerfield, Ill, Covered are the five models that are in production.

on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Self-Propelled

Ditching Machines

man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 5.7 T, model W-2 and a new midget ditcher, model 4.7 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

Padlocks For Master

and Grandmaster Systems

573. A grandmaster-keyed padlock instal-lation or combined master-keyed and keyed-alike sets are described in literature available from Master Lock Co., Milwaukee, Wisc. Steel and brass padlocks, combination padlocks and hasp lock and hasp are a few of the locks described.

Complete Line of **Asphalt Patching Mixers**

586. Mixers capable of mixing 3 to 29 tons of hot mix per hour are described interature available from McConnaughay Mixers, Inc., Lafayette, Ind. Cheek the reply card for full information on patching, repairing, resurfacing and sealing.

Portable Water Coolers Used on Maintenance and Construction Work

451. Igloo cans and coolers are permalined and range in capacity from 2 to 15 gals. Models and sizes are covered in bulletin available from Igloo Corp., P. O. Box 8227, Memphis 4, Tenn., or by checking the reply eard.

Data on Portable and Stationary Air Compressors and Accessories

652. Covered in literature available from Gordon Smith & Co., Inc., Bowling Green, Ky., are the basic designs of portable air compressors, models, operating features and specifications. models, operating feather Check the reply card.



POWER LINES VULNERABLE

Wherever there may be a tornado, earthquake, flood or other disaster the saving of many lives and millions in property damage can be accomplished by fast restoration of power.

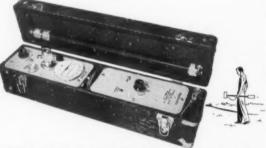
Within SECONDS of power failure Synchro-Start Controls activate any stand-by engine to produce emergency power for vital utilities such as, fire protection, communications, light and refrigeration. When main line power is restored the controls quickly transfer the load.

SYNCHRO-START PRODUCTS, INC.

8151 N. RIDGEWAY AVENUE ILLINOIS SKOKIE

THE NEW MINIATURIZED WILKINSON LINE LOCATOR MODEL W-3

This radically new, powerful, transistorized locating instrument weighs only 4 pounds and is 1/4 as large as old type pipe locators.



It's as handy as a flash light. The transistors rarely, if ever, require replacement; non-leak mercury cells outlast old type batteries at least ten times. The instrument cases are molded glass fibre. The alumi-num connecting handle telescopes to 17 inches, and the entire instrument comes in a substantial carry-

Write today for illustrated brochure and instruction manual.

WILKINSON PRODUCTS COMPANY 3987 Chevy Chase Drive,

Pasadena 3, California SYlvan 0-4314





SEAMAN-ANDWALL SELF-PROPELLED TRAY-L-PLANT (Diesel-Powered - With Volumetric Meter)

- Exclusive mixing action of the adjustable-depth rotor corrects segregation in the base. The binder — either bitumen or water — is applied by the spray bar directly into the material to produce a uniform mixture.
- Application of binders is accurately controlled by the metering system, and is simultaneous with mixing action. Complete stabilization in one continuous operation.
- The spray bar is positioned at the most efficient mixing point just ahead of the rotor. It applies bitumen or water directly into the mix and eliminates surface run-off or migration of bitumen — or evaporation in the case of water.
- Positive mix is obtained by accurate metering system which automatically controls and records total binder gallonage used, gallons per minute used and feet per minute covered.

SEAMAN-ANDWALL CORPORATION

A Subsidiary of the American-Marietta Company, Milwaukee 1, Wisconsin, Cable address: SEANCO

Manufacturers of the Sta-Bilt Line for Better Roads

 Pulvi-Mixers • Trav-L-Plants • Pneumatic Compactors • Steel Wheel Rollers Century Material Spreaders • Pulvi-Breakers • Vibro-Joint Cutters

MODEL 5620 / SPECIFICATIONS



SEAMAN-ANDWALL 7-20 TON PNEUMATIC COMPACTOR (Gasoline or Diesel-Powered)

- New "straight-down" pressure principle made possible by front wheel drive offers the best possible compacting efficiency. Surface shear, scuffing, material displacement is eliminated . . even in turning.
- Easy to operate and extremely maneuverable can make a full 180° turn on an 18-foot road. Simple levers control both the power steering and the automatic transmission, as well as the auxiliary 2-speed

transmission

- Complete flexibility in operation—4 forward speeds from 1 to 20 MPH—2 reverse speeds from 2 to 9 MPH—along with an extra-low center of gravity make this one of the most practical and versatile of all road rollers.
- Only roller built with watertight ballast compartment

SEAMAN-ANDWALL CORPORATION

A Subsidiary of the American-Marietta Company, Milwaukee 1, Wisconsin, Cable address: SEANCO

Manufacturers of the Sta-Bilt Line for Better Roads

 Pulvi-Mixers * Trav-L-Plants * Pneumatic Compactors * Steel Wheel Rollers Century Material Spreaders * Pulvi-Breakers * Vibro-Joint Cutters

MODEL HY-4 and HY4-6 / SPECIFICATIONS



SEAMAN-ANDWALL CENTURY SPREADERS (Dual Purpose)

- \bullet Adaptable to all spreading requirements spreads any aggregate or combination of aggregate up to $1\frac{1}{2}$ inches including wet, stock-piled material.
- Can be used the year around conversion from a spinner operation to a sealcoat unit is quick and easy. Powered screen agitator prevents bridging or channeling.
- \bullet Accurately controlled application width of spread with the spinner is adjustable from 2 to 40 feet . . . with the sealcoat tray, from 2 to 9 feet.
- Completely automatic width of material to be spread is hydraulically cab-controlled, operated by truck driver alone.

SEAMAN-ANDWALL CORPORATION

A Subsidiary of the American-Marietta Company, Milwaukee 1, Wisconsin, Cable address: SEANCO



Manufacturers of the Sta-Bilt Line for Better Roads

* Pulvi-Mixers * Trav-L-Plants * Pneumatic Compactors * Steel Wheel Rollers
Century Material Spreaders * Pulvi-Breakers * Vibra-Joint Cutters

SEAMAN-ANDWALL TRAV-L-PLANT and PULVI-MIXER

In Bituminous Stabilization

- Coats aggregates thoroughly and uniformly
- Achieves plant mix quality at road-mix cost
- Provides a superior mix with asphalts, emulsions, oils and tars
- Blends out "rich" and lean areas to uniformity
- Blends coarse and fines to a homogeneous mix
- Reclaims old, worn-out bituminous pavements
- · Aerates solvents quickly
- TRAV-L-PLANT prevents binder migration

In Soil-Cement Stabilization

- Achieves optimum moisture accurately
- Provides uniform mix of cement and aggregates or soils
- Mixes a mile a day of 24 foot road
- Leaves mix shaped to final crown and grade, ready for compaction
- Pulverizes clods of clay
- Dries over-wet soils
- TRAV-L-PLANT prevents excessive moisture evaporation

In Salt, Calcium Chloride or Lime Stabilization

- Achieves a perfect mix generally in one operation
- Achieves a dense, tight, water and frost resistant base
- Mixes and interlocks aggregates; fills voids with fines
- As in all mixing operations, greatly reduces costs
- Provides uniform distribution of the water increment
- New work or reconstruction of old surfaces equally simple

In Water-bound Macadam Construction

- Produces a tightly knit base in one operation superior to old fashioned hand placement and Brooming-in of fines
- Large daily production
- Fractional production costs
- Keys and interlocks crushed stone, eliminates voids or pockets
- Provides a high type of base or sub-base at minimal cost



The Seaman-Andwall TRAV-L-PLANT mixing for a salt stabilization of a county gravel road in Colorado.

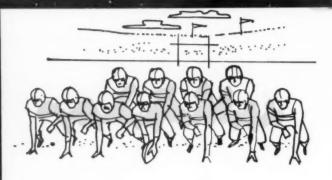
Photo was taken from the Seaman-Andwall 5620 (7 to 20 ton) Pneumatic Compactor which followed immediately behind the Mixer. Notice the thorough and uniform blending and placement of materials in the mix.



The Seaman-Andwall 5620 Pneumatic 7 to 20 ton Compactor rolling out a high type of bituminous mix. Because drive is direct to front tires, the compaction force is straight down which eliminates the usual pushing action that otherwise causes surface shear, scuffing, material displacement or other disturbance of material. The Compactor is able to make a full 180° turn in a 18 foot roadway. Unusually low center of gravity provides operator safety even on 3 to 1 slopes.



Spreading for a salt stabilization with the Seaman-Andwall Century Spreader (Model HY-4). Chips, pea gravel and aggregates up to $1\frac{1}{2}$ inches can be similarly spread with the channeled tray for sealcoat work. The tray is removable and a hydraulically operated spinner is quickly substituted for wide spreading of sand, chlorides and similar materials in its control work. The Century HY-4 is completely controlled by one man — the truck driver — from the truck cab.



This Big Orange Team Can Build Your Roads and Streets for Less Than \$3000.00 a Mile *

*This Team successfully built Salt Stabilized roads in Colorado and Wyoming at this cost during 1958.

Highway and municipal street authorities from coast to coast have found a new cost-cutting equipment team to build higher load bearing, weather resistant, longer-lived highways and streets. Today the movement to stabilized construction with the BIG Seaman-Andwall Team has become more than a trend; it's a cross-country sweep.

Any type of stabilization with any binder will cost you drastically less with the BIG ORANGE TEAM.

Captain of the Team is the rugged Seaman-Andwall TRAV-L-PLANT for lowest cost in-place mixing. It's equipped with complete controls for precision admixture of bitumen or water...Additional advantages:

- Fast aeration in dispersing solvents in bituminous stabilization
- Optimum moisture easily obtainable by increment admixture in soil-cement, salt, lime and aggregate stabilization

Heavy, stalwart line-man is the Seaman-Andwall 5620 seven to twenty ton Pneumatic Compactor. Low center of gravity spells safety even on areas with a 3 to 1 slope.

- Will not scuff in rolling hot asphalt mixes.
- Adequately powered for operation at 10,000 ft. levels
- Works effectively on steep grades
- Watertight compartments for fast ballasting

Fleet, accurate end is the Seaman-Andwall Century Spreader. Handles any material—salt, sodium chloride, sand or chips. Can be easily converted with an optional channeled tray to an efficient, accurate sealcoat spreader.

Just lift this page. There's the BIG ORANGE TEAM complete with specifications. The perforations form cards for a convenient 6" x 4" desk file.

SEAMAN-ANDWALL CORPORATION

Elm Grove, Wisconsin

MODEL DTM-47 / SPECIFICATIONS

ENGINE: General Motors 4-cylinder diesel. Model 4057C, 138 HP at 2000 R.P.M.

A057C, 138 HP at 2000 R.P.M.

ROTOR: MFR-A type, 7-foot mixing width. All cast malleable tine plates, friction driven with 10-inch clutch discs. 27-inch tine circle. Friction drive principle enables any pair of tine plates to slip independently when encountering obstructions.

TIMES: "SC" or "Bevel Edge." Heat treated alloy steel for wear resistance.

SC tines are standard equipment and are furnished unless Bevel Edge are specified. Both types are interchangeable. The SC hook type tine is recommended for working heavily compacted surfaces, large aggregate, and bituminous reclamation. Provides maximum cross-mix of material. The Bevel Edge is recommended for mixing of loose soils, fines, or small aggregate. Produces fine pulverization and is unexcelled for additive processing.

SCARIFIER: Underbody type, hydraulically operated.

CHASSIS: 10-inch steel channel construction

HYDRAULIC SYSTEM: Positive displacement engine driven pump with conveniently located manually operated control valves.

FUEL TANK: 53 U. S. Gallon capacity. Welded steel construction, rubber mounted. Equipped with filler strainer, shut-off valve and fuel gauge.

TIRES: Front, 10.00-20. Rear, 15.00-34. (Other sizes

WHEEL BASE: 118" long. Turning radius. 20 feet.

STEERING: Ross cam and lever automotive type. Power steering optional.

SEAMAN SELF-PROPELLED DIESEL-POWERED TRAV-L-PLANT WITH VOLUMETRIC METER

BRAKES: Dual master cylinder, hydraulically operated service brakes on rear wheels. Brake pedals may be operated individually or simultaneously, Parking

DRIVE: 5-speed main and 2-speed auxiliary transmissions. Timken Heavy Duty rear axle, differential missions. Timb

and final drive.

BINDER APPLICATION EQUIPMENT: Wisconsin engine Model VG4DU—Warner Transmission. Roper model 3600-6RV pump with 200 G.P.M. capacity, equipped with relief valve and shut-off valves. Fifth wheel tachometer indicating F.P.M., volumetric meter recording total gallonage and electric tachometer indicating G.P.M. 7-foot spray har with 3-way valve. 3" dia. x 16 foot truck-to-pump suction hose. Strainer assembly. Equipment designed to handle bitumen or water.

DIMENSIONS: Length, 22'3". Width, 7'10". Height,

WEIGHT: 13,550 lbs.

ROTOR SPEED: 215 R.P.M. at 2000 R.P.M. Engine speed. 2-speed rotor drive, 215 or 350 R.P.M.

RATE OF TRAVEL AT 2000 R.P.M. ENGINE SPEED: Aux. Trans. Aux. Trans.

| Equipped with filler | Gear | Low | Range | High Kange | | | |
|---------------------------|----------------|---------|--------|------------|--------|--|--|
| gauge. | Gear | F.P.M. | M.P.H. | F.P.M. | M.P.H. | | |
| 5.00-34. (Other sizes | 5th | 679 | 7.8 | 1242 | 15.0 | | |
| | 4th | 561 | 6.4 | 1034 | 11.9 | | |
| di 00 ft | 3rd | 298 | 3.3 | 545 | 6.2 | | |
| g radius. 20 feet. | 2nd | 166 | 1.9 | 303 | 3.4 | | |
| er automotive type. | 1 st | 97 | 1.0 | 175 | 2.0 | | |
| | Rev. | 164 | 1.9 | 298 | 3.3 | | |
| Specifications subject to | change without | notice. | | | | | |

MODEL 5620 / SPECIFICATIONS

SEAMAN-ANDWALL SELF-PROPELLED GASOLINE OR DIESEL-POWERED 7-20 TON PNEUMATIC COMPACTOR

ENGINE: 226 Cu. in., 75 H.P. 6 Cylinder Continental Gasoline Engine equipped with electric starter. Continental HD260 Diesel Engine. Brake HP at 2000 RPM, 59. Max Torque at 1100 R.P.M., 188 Lb. Ft. TRANSMISSIONS: (Gasoline powered) Warner Torque converter, Warner automatic transmission, Fuller

converter, Warner automatic transmission, Fuller auxiliary 2-speed. (For Diesel only) Long converter, Funk Revers-o-matic. Warner T-9, 4-speed transmission.

SPEEDS: Gasoline powered) Forward—2 speeds from 1 to 20 MPH. Reverse—2 speeds from 2 to 9 MPH. (For Diesel only) Forward—4 speeds; 2.3 MPH to 15.9 MPH. Reverse—4 speeds; 2.3 MPH to 15.9 MPH. FUEL TANK: 40 Gallon Capacity.

CUITCHES: 16 clutch facings of 8" diameter located in front wheel roll. Each wheel is independently driven with 2 clutches to prevent scuffing of the rolled surface: the clutch pressure being hydraulically adjusted, at the operator's platform for various rollconditions

BRAKES: Automotive type hydraulic brakes on rear axle. Mechanical brake on front drive line.

STEERING: Through a "constant" torque mechanism permitting 180° travel with a 5" diameter hydraulic

cylinder. Turns completely in 18-foot roadway.

DIMENSIONS: Wheelbase, 132"; Overall length, 211"; Overall width, 92"; Rolling Width, 92"; Ground clearance, 11"; Overall height, 71".

WHEELS: Front Drive Roll, 8 wheels; Rear Roll,

TIRES: 7.50-15 smooth tread, 6 ply, 8" wide copaction type. Operating tire pressure — 35 lbs. 90 lbs.

SPRINKLER SYSTEM: 360 gallon capacity — provides spray on each tire, front and rear. Pump-driven sprinkler system standard equipment.

BALLAST: Water or sand or both.

ELECTRICAL SYSTEM: 6 volt system, includes sealed beam headlights, and taillight (12 volt for Diesel). WEIGHTS: With Ballast

| Gross W | eight — Empty | Water | Dry Sand |
|---------|---------------|--------|-------------|
| Front | 10,000 | 14,940 | 19,770 |
| Rear | 5,000 | 16,800 | 22,240 |
| Total | 15.000 | 31.740 | 42.010 |

Specifications subject to change without notice.

MODEL HY-4 and HY4-6 / SPECIFICATIONS

SEAMAN-ANDWALL CENTURY SPREADERS

MATERIAL: Positively spreads any aggregate or any combination of aggregate up to $1\frac{1}{2}$ inches including wet, stockpiled material. Powered screen agitator prevents bridging and channeling. A lug type auger reduces coagulated, crushable material to spreading

POWER: Hydraulically operated from power take-off of truck engine. Needle bearing pump, motor and "U" joints supplied in complete premachined universal mounting kit. Hydraulic system safety relief valved at twice the operating pressure to prevent unit damage from foreign non-crushable material.

damage from roreign non-crustatore material.

ADAPTABLITY: May be mounted on any standard truck (6½ ft. and over). Spreader trough rests against the inside of truck tail gate. Tail gate chains hold unit securely in place. No need for welding or bolting to dump body. No necessity for removing and storing tail gate.

SPREAD WITH SPINNER: Operation: Completely automatic. Push button controlled by driver from truck cab. Spreader gates automatically opened and closed when unit is engaged or disengaged. Speed of spinner instantly adjustable from 0 to maximum from truck cab to regulate width of spread. Spreads with equal efficiency while operating in reverse or forward. forward

Width of spread: 24 inches to 40 feet.

Depth of spread: From minimum of 100 lbs. of chlorides per running mile of roadway, for ice and dust control, to a maximum amount of aggregate required in applying a single pass sealing or armor

Direction of spread: Simple adjustment places ma-terial to the left, right, ahead or to the rear of truck at any desired direction.

Angle of spread: Spinner remains level to roadway, angle of dump body discharging full or almost empty load does not alter level position of rotating spinner

SPREAD WITH TRAY: Adaptability: Spinner can be detached and Seal-Coat Tray accessory positioned for service within 15 minutes.

Control: Driver-operated automatic flow control lever on truck dash instantly starts and stops material flow. Precise engineering of calibrated tray provides width of spread from 2 to 9 feet, and any desired depth with perfect uniformity and sharp cut-off.

TROUGH CONSTRUCTION HY-4: Welded heavy gauge reinforced steel. Spreader width adjustable for any dump body with $6\frac{1}{2}$ or more inside width. Depth. 14". Height, 32".

TROUGH CONSTRUCTION HY4-6: Same as above — for 6' truck body.

BEARINGS: Agitator and stabilizer bearings permanently sealed. SEALMASTER prelubricated self aligning ball type.

GEAR BOX: 1/4" wall cast iron case, sealed ball bearings. HYDRAULIC COMPONENTS: Century built; guaranteed for one full year

SHIPPING WEIGHT LESS TRAY: Approximately 580 lbs.
WEIGHT — TRAY ACCESSORY: 130 lbs., including special vibrator assembly.





A VOTING MACHINE UNLEASHES AN ADDED 300 MILLION GALLONS OF WATER DAILY!

A flick of a lever by an overwhelming number of New Jersey voters set in motion a long range program for supplementing the State's already over-burdened water resources with an additional 300,000,000 gallons of water per day.

The economic future of your community too, depends on farsighted water works planning—such planning deserves to be implemented with the best—LOCK JOINT CONCRETE PRESSURE PIPE.

Durable—low cost—easily installed—LOCK JOINT CON-CRETE PRESSURE PIPE, because of its minimum maintenance requirements and permanent high carrying capacity, solves tomorrow's pipe line problems TODAY, economically.



LOCK JOINT PIPE CO.

East Orange, New Jersey

Sales Offices: Chicago, III. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo. • Perryman, Md.

Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

St. Louis area depends on



CITY OF ST. LOUIS STREET DEPARTMENT

This is the model H-70 "PAYLOADER" of the St. Louis Street Department when delivered last Fall - equipped with Drott 4-in-1 bucket and including a Ram Rotary Plow attachment and a Ram Pick-up Sweeper attachment. On hand for the event were three Street Department officials: left to right, Robert Moschoff, Supt.; Charles Gilmore, Commissioner; Leo Schumacher, Auditor. They will keep this "PAYLOADER" busy all year. The blower plow attachment has been useful this Winter loading snow from the downtown area.

The Pick-up Sweeper attachment has a special 4-month Summer job connected with sealcoat street surfacing - sweeping up and saving the excess stone chips. They won't have to depend on borrowing a sweeper from another department and can clean up the chips right away before they become scattered by traffic and wind. Notice the right and left gutter brooms that enable them to work left-hand gutters of one-way streets without bucking traffic.

The balance of the year, the "PAYLOADER" uses the versatile 4-in-1 bucket and does all kinds of jobs - removing trees and stumps, excavating, alley-widening, grading. In fact, it's an all-around-the-town, one-man gang for loading, bulldozing, scraping and crane duties.



LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY





CITY OF ST. LOUIS WATER DIVISION

The St. Louis Water Division likes its Model HF "PAYLOADER" so well that E. G. Gammeter, Water Dept. Superintendent, took time to write a letter. It tells of the Model HF's uses and benefits so clearly that we are reproducing it

About a year ago we purchased a Hough HF 'PAYLOADER', with a Wain-Roy back hoe attachment. It has done such a tremendous job for us, that we want to express our appreciation to you for making this equipment

'We hope to pass on to others in the Water Works field the versatility of this combination

"We have loaded 16 foot lengths of 20" pipe, dug, laid, installed and backfilled 250 foot of 8" main in a day. It eliminates hauling cost of a float and driver. Its ability to do small jobs as well as the usual main-laying, has made it a prize piece of equipment. Tough jobs in close quarters, which formerly necessitated long hours of hand digging, are cleaned up in record time.

"With today's bigh labor cost, we feel we bave in this short time saved the cost of this unit. It is indeed a pleasure to recommend this combination unit to any other comparable utility."

LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY



PAYLOADER[®] versatility



CITY OF JENNINGS STREET DEPARTMENT

This St. Louis suburb is as enthusiastic about the "PAYLOADER" with Drott 4-in-1 bucket as is its big neighbor.

Roy Hennen, Road Commissioner, says of the Model HU, "This 'PAYLOADER' with torque converter drive and power-shift transmission is so simple to operate that any man in the department can do a passable job with it. Our experienced operators have become experts and our road construction, maintenance and repair costs are the lowest in recent years. This is a multi-purpose unit that, in many cases, can outperform specialized single-function machines."

One of its recent projects was on the improvement of a 15-acre plot for a playground. The Model HU practically did the job "singlehanded". It cleared excess trees, removed and piled stumps for burning, backfilled 450 ft. of 30" concrete drain tile, in addition to much grading and loading work.

There are many other "PAYLOADER" attachments of particular interest to public work departments that enable their versatile tractorshovels to do other specialized work - such as the Black-top Spreader, the Vibratory Soil Compactor and the Side Boom. There's a proven 'PAYLOADER" size and type to fit your need plus attachments to fill many special-machine roles.







ST. CLAIR COUNTY, ILL. HIGHWAY DEPARTMENT

Across the river from St. Louis is St. Clair County, Illinois, owner of this Model HU 4wheel-drive "PAYLOADER" and an older two-wheel-drive Model HF.

Operator Bert Jorn says, "I load chips in Summer, cinders in Winter and just about everything else when I have time. The Model HU has the right speed and the right power to bandle big jobs well and small jobs economically. It is easily the busiest machine the county owns."

Here the HU is helping out as the County hurries the cleaning of its roadside ditches before Winter comes. The County has a specialpurpose loader for this job, but it needs the help of the "PAYLOADER", which is nearly as fast as the special machine and, according to the truck drivers, has the advantage of doing a cleaner job.

THE FRANK G. HOUGH CO.

761 Sunnyside Ave., Libertyville, III.

Send data on PAYLOADER tractor-shovels and attachments for Public Works

Title

Govt'l. Unit

Address

THE FRANK G. HOUGH CO. LIBERTYVILLE, ILLINOIS
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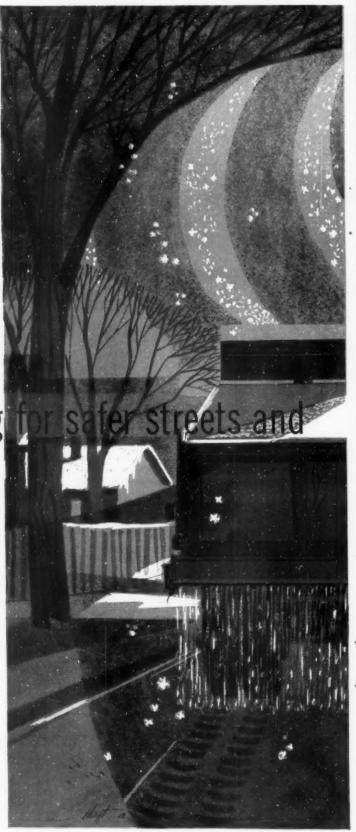
Now use Morton Rock Salt all year long

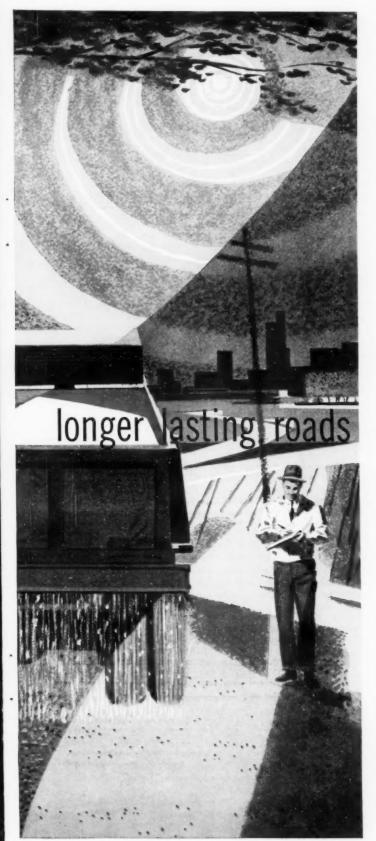
The best, most economical way to help keep your streets safe during winter months is to use straight Morton Rock Salt.

Straight Morton Rock Salt gives abrasive traction against skidding before it starts to melt the ice. Morton Rock Salt crystals are larger than other commonly used ice melting chemicals and penetrate ice deeper with a corkscrew action—not just melt surface ice. This better penetration means Morton Rock Salt reaches the pavement fast and quickly melts the bond between ice and street surface.

Morton Rock Salt is safe, clean, economical

Straight Morton Rock Salt is non-toxic. It does not damage animals' paws, rubber, fabrics, leather, asphalt, brick or properly seasoned concrete. It will not clog sewers or leave a rutted, dirty pavement as will sand and cinders. What's more, Rock Salt melts more ice at lower cost at any temperature above 8° F. than any other commonly used ice melting chemical.





You reduce aggregate loss, save man-hours and maintenance costs when you stabilize your roads with Morton Rock Salt.

Secondary roads stabilized with Morton Salt give more service per dollar than roads built by any other method—and the savings in aggregate alone more than pay for the salt. You get smooth, durable, water-repellent surfaces that require minimum maintenance.

Stabilizing the base course of primary roads with Morton Rock Salt helps prevent the 9 out of 10 road failures which result from faulty foundations.

Stabilizing shoulders with Morton Rock Salt not only checks erosion and rutting, it reduces dust and eliminates accidents caused by soft shoulders. You also save on grass and weed removal.

Road stabilization ends problem of winter salt carry-over

The proven value of salt stabilized roads means city, county and state highway officials no longer have the problem of how much rock salt to order for ice and snow removal. Now you can order an adequate amount of rock salt for winter protection. If you have a milder winter than anticipated, the extra rock salt can be put to excellent use for summer road stabilization projects.

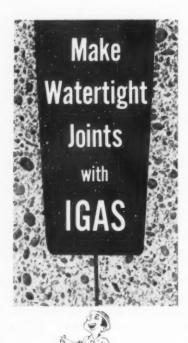
Mail coupon today!

I would like free additional information about the advantages of using Morton Rock Salt for both ice and snow removal and stabilizing roads.

| Name | | | |
|---------|--------|-------|--|
| Title | | | |
| Address | | | |
| City | County | State | |



PUBLIC WORKS for March, 1959



Igas Joint Sealer is a non-meltable, mastic waterstop that is easily applied to joints after the concrete has hardened. Igas will not dry out or become brittle when subjected to climatic changes. It can be placed in vertical, horizontal and overhead joints, thus forming an effective, watertight seal, Igas is ideal for foundations, basements, swimming pools, tunnels, etc. For complete information about Igas, write for Bulletin IS-56.



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PRINCIPAL CITIES - AFFILIATES AROUND THE WORLD



LEGAL ASPECTS

OF

PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Relocation of Gas Lines

Southern California Gas Co. v. City of Los Angeles, 329 Pac. (2d) 289, a California case decided Aug. 29, 1958, was an action by a gas company to recover the cost incurred in relocating certain of its lines in the county as a result of sewer construction by the city.

The City of Los Angeles constructed the La Cienaga and San Fernando Relief Sewer as part of a sewer construction program. A short section of the sewer line passes under a narrow strip of land known as the County Strip, located outside the city limits in an unincorporated area of the county of Los Angeles. To construct the sewer it was necessary to relocate gas lines of the Southern California Gas Co. The company agreed to relocate its gas lines in the County Strip subject to a later determination of its obligation to do so at its own expense. It conceded its obligation to relocate its lines at its own expense within the city limits but denied that it had the same obligation with respect to its lines located in the County Strip. After the work was completed it brought action against the city to recover the costs incurred in relocating its County Strip lines and recovered a judgment for over \$12,000. The City appealed.

The bases for the decision in the lower Court were that: (1) The county franchise expressly required the gas company to relocate its lines when the county changed the grade of a highway, and that this negatived any other obligation to relocate its lines at its own expense; and (2) In any event, even if the company owed an implied obligation to the county to relocate its lines at its own expense in other cases, this obligation did not extend to the city.

The Supreme Court of California refused to accept either of these

arguments as valid, and reversed the lower court decision. In its decision, the higher court held that where there is no provision in a franchise abrogating its commonlaw obligation to relocate its pipes at its own expense, the gas company must move them at its own expense. Furthermore, this obligation is not limited to the county granting the franchise, but extends for the benefit of the people of the state. The City acts as an agent of the state for this purpose.

Leaky Hydrants

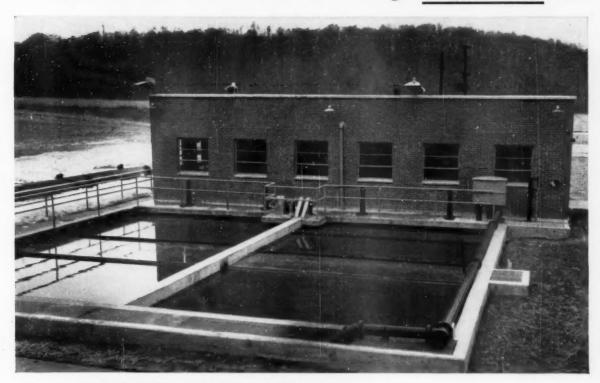
Koch Bros. Bag Co. v. Kansas City, 315 S.W. (2d) 743, a Missouri case decided July 14, 1958, was an action for \$8,800 property damage from leakage of water from a city hydrant into the plaintiff's basement.

Loyd Riley, plaintiff's foreman, first discovered water running from the basement wall on June 23, 1951. The City was notified and the water stopped. The same thing happened on three other occasions (July 15, July 28, and August 21) and each time, after the City was notified, Riley saw someone working on the water plug on the corner adjacent to defendant's building. Mr. Koch, plaintiff's president, said on the occasion of the first leak, that he heard a humming sound in the hydrant which stopped when a Water Department employee used a wrench on it, but the water continued to flow for some time. On the three later occasions, water again ran into the basement but stopped after Water Department employees turned off the hydrant. Shortly after the last occurrence, the City had some people out who broke up the sidewalk around the hydrant and did some repair work, working on the valve.

Six months after the last leakage, the hydrant was replaced because it was worn out, and as part of the program for replacement of obsolete

City of Sidney, Ohio

Gets Smooth Measurement of Sludge Magnetically!



... WITH FOXBORO MAGNETIC FLOW METER

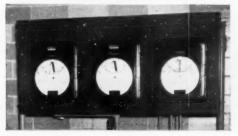
"The Foxboro Magnetic Flow Meter on return activated sludge went into operation so smoothly that no one paid any attention to it. They haven't done a thing to it since, and it's still operating smoothly."

That's the comment of W. D. Sheets of Ohio State University, Technical Adviser for the new Sidney, Ohio, sewage plant. It's a typical perfect-performance report on the Foxboro Magnetic Flow Meter, a modern flow meter that's always easy to install, simple to operate, practically maintenance-free.

No line restrictions — no pressure taps to plug up. With the Magnetic Flow Meter, there's nothing in the line to cause pile-up of solids. And you can forget about purging of pressure taps — there aren't any! Electrical cable carries measurement signal to remote Dynalog* Electronic Recorder, providing a direct magnetic measurement of fluid velocity. Get full details on this unique development in flow meters. Write for Bulletin 20-14A. The Foxboro Company, 263 Norfolk St., Foxboro, Mass., U.S.A.

*REG. U.S. PAT. OFF.

All Flow measurements are recorded by Foxboro Instruments centrally located in the plant director's office of the Sidney plant. Shown below, left to right, are: Air Flow Recorder with integrator; Sewage Flow Recorder with integrator; Dynalog Recorder for return activated sludge.



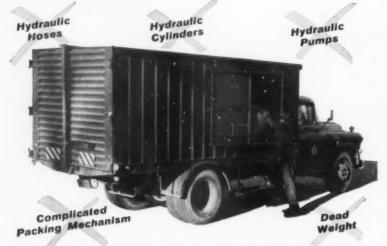
FOXBORO



FIRST in FLOW

This compact, troublefree Foxboro Magnetic Flow Meter is installed right in the return activated sludge line at Sidney, Ohio's modern new sewage plant. There's nothing in the line to obstruct flow in any way... no pressure taps or purges.

Look what the M-B PACKER eliminates!



Simple design enables you to haul more tonnage at lowest cost

- . LESS MAINTENANCE
- . LOW OPERATING COST
- . FEWER PACKING CYCLES
- . MORE THOROUGH COMPACTION

Put a simply designed M-B Packer on your routes and you eliminate all the trouble and extra expense associated with hydraulic refuse collection bodies. A simple, powerful cable driven packer plate thoroughly compacts all types of refuse and garbage. The absence of heavy, complicated hydraulic mechanisms gives you a body that weighs less per cubic yard of capacity...one that can be mounted on smaller, less expensive trucks. Operation is simple, maintenance cost is negligible and production time on the route is increased. Compare the M-B Packer from every angle, then call your distributor for a convincing demonstration. M-B Corporation, New Holstein, Wisconsin.



Easy Loading of Bulky Objects

Huge crates, boxes, cartons, barrels can be loaded quickly and without pre-crushing.



Big Loads Push Out Easily

At the dump or incinerator the full-pack load is pushed out the rear without raising the body. It's simple, foolproof, safe!

MUNICIPAL EQUIPMENT SINCE 1907

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PACKIR BODIES

hydrants. Water plugs are constructed with small drains in the base to prevent freezing and damage to the plug in cold weather, and if a hydrant is not turned off completely, water may flow from the water line through the drain.

A search of the Water Department records did not disclose any use of the hydrant by the Water Department during the time in question. It was possible, however, that street cleaners may have done so in their work.

The Supreme Court of Missouri held, under these circumstances, that the City was not automatically free of liability if it could not be shown that they had operated the hydrant. The City could be held liable for negligent maintenance and failure to repair or replace the hydrant if it was defective because worn out and not operating properly. This was a question of fact for the jury to decide in a new trial.

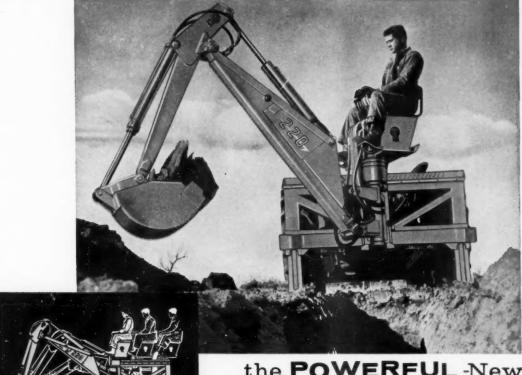
This decision is in accord with the weight of authority. It is generally held that municipalities are liable for damages caused by defects in hydrants or pipes connecting them with the water mains, even if the hydrants are used solely for fire purposes. (However, damages resulting from the use of hydrants by the fire department, cannot be recovered from a municipality, on account of its governmental immunity.)

City Docks

Paper Makers Importing Co. v. City of Milwaukee, 165 F. Supp. 491, decided by the United States District Court in the Eastern District of Wisconsin on Sept. 19, 1958, was an action by importers of cargo on ships against the city for breach of contract by the city harbor commission, for failure to unload cargoes at the city's port facilities as per contract.

The city's principal defense was that it was excused from performance by unavoidable causes and circumstances beyond its control. The contract contained a clause reading as follows: "The Board [of Harbor Commissioners] shall not be responsible for loss or damage to freight in its possession caused by fire, frost, heat, leakage, failure of building, animals, insects, dampness or the elements, nor will it be responsible for any delay, loss or damage arising from riots, strikes, war, insurrection, or any cause un-avoidable or beyond its control." The city's defense was based on the fact that there had been a strike at the consignee's plant, that there had been some picketing, and that

the GREATEST BACKHOE of ALL!



GETS READY TO FLUSH DIG IN LESS THAN 5 MINUTES

To slide the Davis 220 into any one of five digging positions, simply loosen four cap screws, then move the most assembly on the slide rail by actuating the boom cylinder. Retighten. Notice how seat moves along with the digging assembly so you sit right over your work for unmatched visibility. Rotary hydraulic boom swing cylinder provides 200° continuous operating arc.





the POWERFUL New M-F Davis 220

with Hydra-Slide Positioning for Digging Assembly and Operator

The Davis Backhoe – already accepted as the industry's pattern setter, and the first machine ever to dig flush, has many new functional features that give you more profit-making advantages than any other backhoe.

more profit-making advantages than any other backhoe.

The new Massey-Ferguson Davis 220 now has "Hydra-Slide" positioning so you can easily move the entire digging assembly – including the operator's seat so you're positioned right over your work – to any one of five digging positions in less than five minutes. You always look directly into the trench when digging and face the bucket when dumping.

face the bucket when dumping.

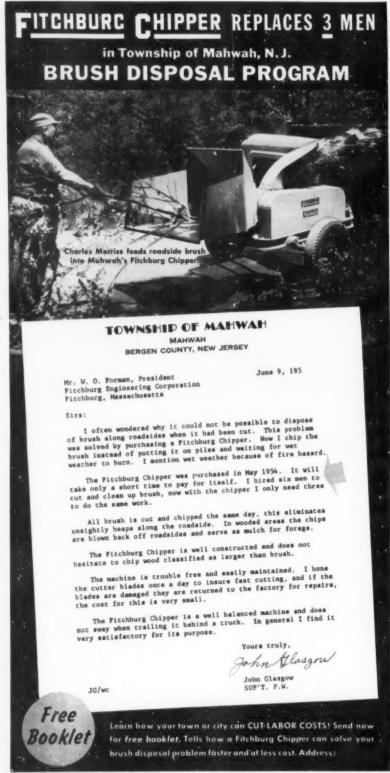
It has new power, too, with 14,000 pounds breakaway.

Increased operating pressure to 2,150 psi, combined with larger bucket cylinder shaft, gives 50% faster dumping.

All around it's a better, more powerful backhoe, with more utility than any other on the market. A demonstration by your dealer will prove it. Write for his name.



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FITCHBURG ENGINEERING CORPORATION

FITCHBURG, MASSACHUSETTS . Dept. PW-39

HE HILLSTIN

there had been a threat by certain labor leaders that a general or statewide strike would be called if an attempt was made to unload the ship, with an implication that such a strike might result in public disturbances. However, there was no actual strike called by the dock workers, nor did they in fact refuse to do any work which was ordered.

The court held that threats of strikes were not sufficient to excuse the city from using its best efforts to perform its contract. According to the court: "The city had the duty, in spite of these threats and pressures, to make an actual attempt to unload [the ships]. If initial attempts had been frustrated by disturbances designed to prevent the unloading, the city would have the further duty to exert additional efforts in it; endeavor to perform the contract. A situation might have come into existence had the threats of the labor leaders materialized which would have required the city to apply to the courts for such remedies as were appropriate, including coping with illegal picketing or any violence that might have developed. Moreover, the city had its police force to maintain law and order, which force could have been augmented, if necessary, by outside help. . . [The] responsible city officials made no real or valid attempt to unload [the ships]. Instead, all their efforts were directed toward placating those who were determined that [the ships] should not be unloaded.

The plaintiffs were therefore awarded damages in the amount of \$43,039.88.

Progress in Waste Disposal and Water Treatment

According to the Pennsylvania Department of Health, 44 new sewage treatment plants and 24 industrial waste plants were completed in Pennsylvania during 1958. In addition, 57 sewage treatment and 19 industrial waste treatment plants were under construction. Also, at least 38 new water supply treatment plants were placed in operation during 1958; construction was initiated on an additional 32 plants and improvements were made at five.

The total value of sewerage contracts awarded in Pennsylvania during 1958 is estimated at \$30,000,-000. Federal and state grants totalling \$3,800,000 were made during the year to aid such construction. Planning for legislation to provide incentive-type state grants for sewage treatment aid was initiated.

K&M ASBESTOS-CEMENT SEWER PIPE SIMPLIFIES PLANNING, INSTALLATION, AND MAINTENANCE



You have a crushing strength to match every laying condition . . . because there are 5 new engineering classifications of K&M Asbestos-Cement Sewer Pipe. A Manning Factor of n=0.010 permits fewer lift stations, flatter grades, higher-level filtration plants, and smaller pipe diameters. Tight joints eliminate infiltration.



Unskilled labor can install lightweight K&M Asbestos-Cement Sewer Pipe in any weather . . . without heavy machinery. Joints are permanent and water-tight. You can make connections in two easy steps . . . quickly make branch connections. Lubricate rubber rings . . . slide pipe into coupling. Joint allows a 5° deflection and absorbs vibration.

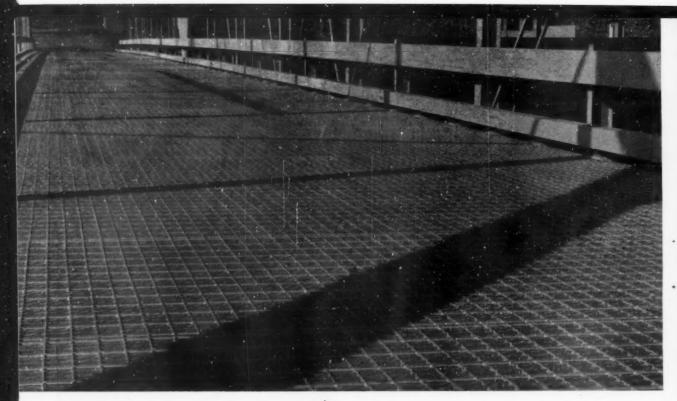


Practically indestructible, K&M Asbestos-Cement Sewer Pipe requires fewer inspections and fewer periodic cleanings. Water can't seep out . . . roots can't penetrate. K&M Sewer Pipe is non-electrolytic and non-corroding . . . because it's made of asbestos and portland cement.

Write to us today for more specific information and for our new booklet on engineering classifications... which contains a handy crushing table based on the Marston formula.



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COMPANY · AMBLER · PENNSYLVANIA



American build more road



Erected in just 5 days. How the dimensional accuracy of USS AmBridge Sectional Plate assures precision fit in the field is demonstrated in the installation of the long pipe-arch shown above. Measuring 112' long, having a 12'6" span and a 7'11" rise, this giant drainage structure was erected in just five working days by a five-man crew, plus crane.

Erected in 4 working days. Above, right: a modern highway-access bridge over railroad tracks at North Branch, Maryland. There were 206 tons of steel involved—one double-plate girder span of 103 feet, and two beam spans (35 feet and 75 feet). Steelwork was erected and riveted in four working days by the American Bridge construction team.

Weight and maintenance problems solved by reflooring old bridge with



AmBridge I-Beam-Lok



The bridge over the West Branch of the Susquehanna River in Clearfield, Pa., has been in continuous use for almost a half century. Its old wooden floor has been patched and resurfaced time and time again. Finally, it was decided to completely refloor the 280' long x 17'6" wide bridge with something permanent. But, switching to another type flooring would not be a simple matter, for existing 12" stringers were too light to carry any additional weight. In fact, it was desirable to lighten the flooring dead load, rather than increase it.

The problem was solved by using 5" open-type USS I-Beam-Lok. Weighing only 18.8 psf., this modern lightweight steel flooring was erected on the old stringers without secondary supports...a total of 4,894 sq. ft. (92,400 lbs.) of it being required for the roadway floor. I-Beam-Lok, being steel, also greatly increased the strength of the bridge and will considerably reduce upkeep and snow-removal costs.

The reflooring was done by the High Welding Company, Lancaster, Pa., I-Beam-Lok specialists.

For further information about the advantages of I-Beam-Lok, ask for a copy of our 32-page catalog.

USS, I-Beam-Lok and AmBridge are registered trademarks

Bridge helps you for the money!



American Bridge Division of



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Just off the pressAll about the Thoro System Products



You will want this for your reference file. A complete and concise 20 page brochure, showing treatment and correction for masonry construction.



Know these and many other products in our New Brochure. They are the answer to your maintenance problems.

Standard Dry Wall Products Inc.
NEW EAGLE, PA. CENTERVILLE, IND.

LETTER to the EDITOR

How Dependable Are Chlorine Residuals?

An editorial in the November 1958 issue of Public Works states:

"Many sanitary defects exist in water supply systems in the form of cross-connections and the possibility of back siphonage. Chlorination provides a safety factor under these conditions but it cannot carry all the load."

Cross-connections and the possibility of back siphonage in water supply systems are serious threats which merit being brought to the attention of your readers. The statement that chlorination provides a safety factor against these hazards will however be challenged by many sanitary engineers because chlorine residuals rarely if ever are maintained at levels high enough to provide effective disinfection in the event of introduction of contaminated materials into a water distribution system through a crossconnection.

It is most important that engineers be aware of the hazards from cross-connections but they must not delude themselves with a mistaken belief that normal chlorine residuals in distribution systems will provide protection against such sanitary defects.

A recent report (January 14, 1958) by the Subcommittee on Water Supply of the Committee on Sanitary Engineering and Environment of the National Academy of Sciences pertains to this subject. This report in part states:

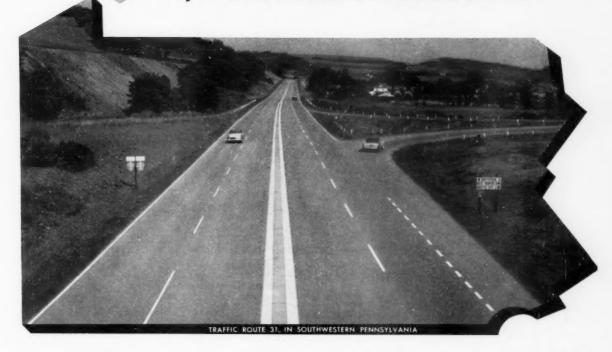
"Residual chlorine, in the concentrations routinely employed in water works practice, will not ordinarily disinfect any sizeable amount of contaminating material entering the system, though this will depend on the amount of dilution occurring at the point of contamination, on the type and concentration of residual chlorine, and on the time-of-flow interval between the point of contamination and the nearest consumer. . ."

H. J. Ongerth
 Senior Sanitary Engineer,
 Bureau of Sanitary Engineering,
 California Department of Public Health,
 Berkeley, California

Editor's Note: PUBLIC WORKS has in this issue a major article on the effect of chlorination of water on the viability of many types of pathogens.

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Average cost per mile for asphalt pavement \$107,347.18

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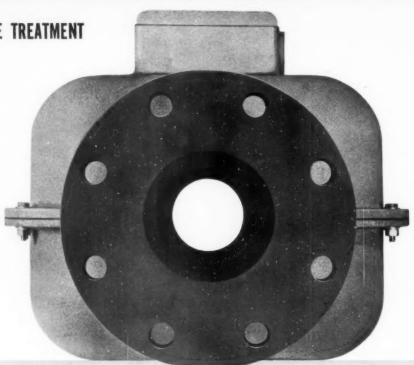


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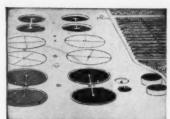
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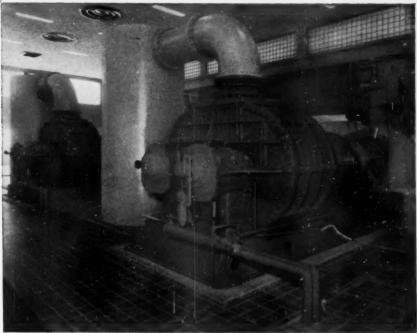
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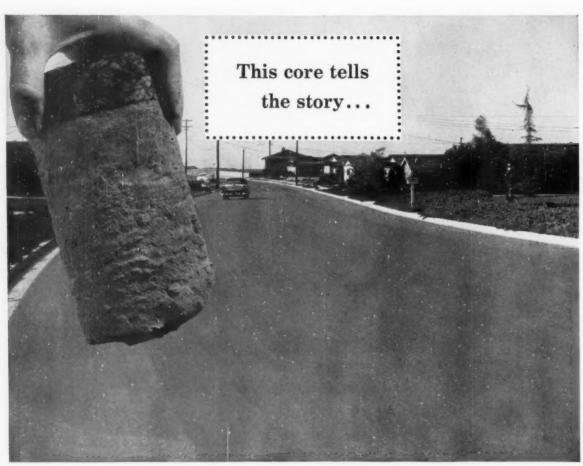
installs easily around beams, piping, machinery or other installations. Needs no maintenance . . . nothing to wear. All surfaces accessible for easy painting.

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Core-tested just after completion in 1954 and again in 1958, this street showed a steady gain in strength. Sample shown in photo above was cored in 1958.

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Soil-cement gives more load-bearing strength per dollar than any other low-cost pavement!

Soil-cement is one pavement that really stretches street budgets.

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This is mixed with portland cement and water, rolled solid and given a bituminous topping. Local traffic can go through on soil-cement pavement right away.

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PUBLIC WORKS for March, 1959

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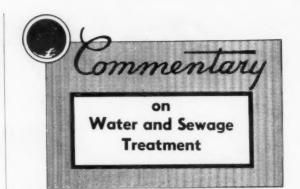


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Trickling Filter Research

R. S. RANKIN

Consultant, Water and Sewage Treatment

RESEARCH in the field of trickling filter media could yield results that would justify greatly increased loadings on both low and high rate filters. It could result in smaller volumes, deeper units and greatly reduced area requirements. This conclusion is based on studies and observations of several authorities, which for the most part have been overlooked or ignored.

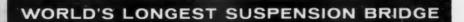
Trickling filter media has remained virtually unchanged for fifty years with a few exceptions which will be mentioned later. A variety of media has been used experimentally including wood blocks, cinders, lath, tin cans and even corn cobs but the presently acceptable standard consisting of rock or slag still remains as it was decades ago. Numerous other external aspects of trickling filters have been explored and these have resulted in a fund of information which has enabled loadings to be increased tenfold. But internally, where the real work of biologic stabilization is performed, research has been notably lacking. Published articles on the mechanism of activated sludge would fill volumes; on the functioning of trickling filter media only a handful of articles have been published.

As long ago as 1908, Hering pointed out that the superficial area of filter media was one of the most important factors in performance and even developed a formula for practical use. In 1936, Levine (1) demonstrated by extensive tests that loadings on low rate filters could be increased substantially over the then current permissible loadings. In so doing he also demonstrated that the surface area of the media per unit of volume had an important effect on performance. As an illustration of this point, comparisons of filter performance, including settling, using 34-in. Raschig rings and 1 to 3-inch stone were reported in Table 1.

| Table Dosing | 1—P | erformance Applied | of Filter | Media |
|-----------------|--------------|-----------------------|-----------|------------|
| Rate | $T^{\circ}F$ | B.O.D. | Remov | al Percent |
| Mgad. | Avg. | Lb/Ac. Ft. | Stone | Rings |
| 2 | 65 | 517 | 87.3 | 93.7 |
| 4 | 52 | 1020 | 71.1 | 81.4 |
| 8 | 56 | 2100 | 75.2 | 79.4 |
| 16 | 62 | 5020 | 78.6 | 89.4 |

Area per cu.ft.: $34\mathrm{-in.}$ rings 75.8 sq.ft.; 1 to 3-in. stone 30.0 sq.ft.

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... these are several of the benefits obtained with POZZOLITH
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At 16 mgad, Levine reported 0.2 mg/L nitrates in the effluent from the stone media and 3.7 mg/L from the Raschig ring media, with no evidence of ponding in either type. From this work it is evident that with proper media a loading rate of 16 mgad could be used even on low rate filters. Unfortunately, there is no record of this work ever being continued, probably because at the time the cost of rock was so low that a more costly substitute was not justified.

The cost of rock media has probably multiplied several times since 1936 and alternate synthetic material now might very well compare favorably costwise, particularly so if the increased superficial area of such a media can be demonstrated to be a major factor in performance, as indicated by Levine's work. A synthetic media of this type obviously does not necessarily have to consist of Raschig rings but it should approach them in area per unit of volume. Likewise the voids, which were 59% for the rings compared to 45% for the rock, should preferably be on the order of 75% or more to insure adequate ventilation. In other industries, where maximum superficial area is required, stone is not used and as a result a number of materials have been developed which provide much greater area than rock per unit of volume. Although the industrial types might not be applicable to trickling filters, certainly intelligent research can produce something more useful than the prevailing piece of rock.

In this connection, The Dow Chemical Co., who have developed a synthetic filter media known as Dowpac (2) have made probably the first real contribution to trickling filter construction in years. They have successfully demonstrated operation at loadings far above normal with excellent results. If one may comment on this media however, a reduction in free space between sheets from one inch to half an inch would seem to be worth exploring. This would increase the area per unit of volume well above that of typical rock media and clogging should still not become a problem.

Currently, biologic treatment by the activated sludge process is favored for many of the larger installations, mainly because of reduced area requirements compared to trickling filters. It would be interesting to conjecture which process would be favored if the area requirements were reversed. This reversal could happen if some of the latent qualities of the trickling filter were thoroughly explored and developed. This possibility may be illustrated by a comparison of present requirements with those of an assumed uprated trickling filter.

Assuming a flow of 1.0 mgd with a settled BOD of 120 mg/L and treatment using (1) a high rate filter 5 ft. deep, loaded at 2400 lb.BOD/AcFt; and a 1:1 recirculation; (2) a low rate filter 6 ft. deep loaded at 600 lb/AcFt with no recirculation; and (3) an activated sludge plant with a 15-ft. deep aeration tank loaded at 30 lb./1000 cu. ft. and 25% return sludge, each including primary and secondary clarifiers rated at 800 gpd/sq. ft., the following values represent present practice:

| Process | Area | Volume |
|------------------|--------------|---------------|
| High rate filter | 7,390 sq.ft. | 55,700 cu.ft. |
| Low rate filter | 14,600 " | 97,500 " |
| Activated sludge | 5,020 " | 61,200 " |

Now assuming that improvements in media would provide additional surface area such that *four* times the foregoing loadings can be applied to the filter

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and twice the depth, indicated by Dowpac, can be used, the results are as follows:

| Process | Area | Volume | |
|------------------|--------------|---------------|--|
| High rate filter | 4.200 sq.ft. | 42,000 cu.ft. | |
| Low rate filter | 4,000 " | 43,200 " | |
| Activated sludge | 5,020 " | 61,200 " | |

These results are not as visionary as they may seem. Dowpac has been operated at loads well in excess of these rates with good results and with depths up to 40 ft. There is reason to believe that through sufficient research and development such rates can become established facts. Trickling filters with adequate underdrainage and an open media possess the inherent advantage of an unobstructed access to the unlimited supply of oxygen in the air. The radical changes in loading could conceivably require an entirely new method of distribution.

The large backlog of sewage treatment needs and the demands of the future justify continuing research and development in this broad field. In the trickling filter media field where progress has been virtually nil for generations it seems opportune to do something about it.

References

- Max Levine et al Observations on Ceramic Filter Media and High Rates of Filtration, Sewage Works Journal, Vol. 8 1936, Pg. 701.
- 2. Dow Chemical Co. Bulletin 171-113. Dowpac 1958.

Interstate Road Construction

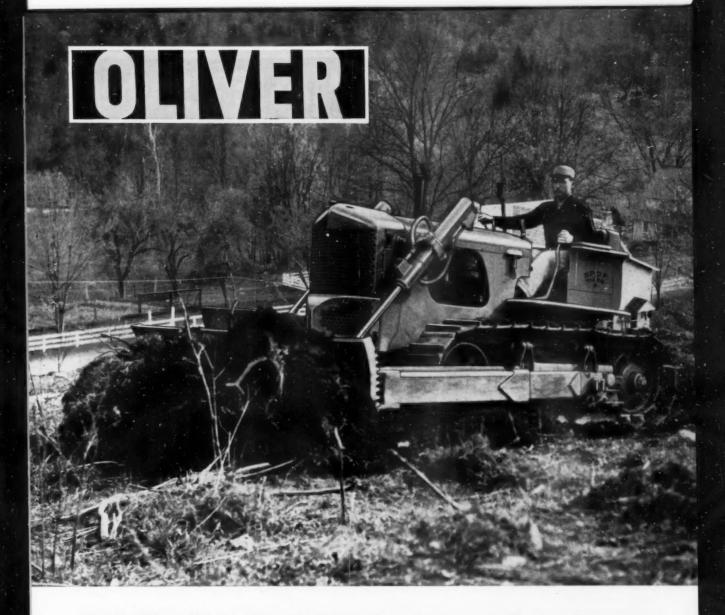
Construction contracts on 236 miles of the National System of Interstate and Defense Highways, including 244 bridges, were awarded during November, 1958, at an estimated cost of \$154 million. Figures from the Bureau of Public Roads, showed that preliminary engineering worth \$8 million and right-ofway acquisition estimated to cost \$31 million were authorized during the month. Construction contracts were completed in November on 240 miles, including 194 bridges, at a cost of \$109 million.

As of November 30, construction was under way on 3,710 miles of the Interstate System, at an estimated cost of \$2.32 billion. Construction contracts have been completed since July 1, 1956, on 2,788 miles at a cost of \$796 million. Included in the program were 3,731 bridges under way and 1,835 completed. In addition, \$1.77 billion had been authorized or spent for preliminary engineering work and acquisition of right-of-way since July 1, 1956.

In the continuing program of Federal assistance for the improvement of the Federal-aid primary and secondary highway systems and their urban extensions (the ABC program), construction was authorized on 1,686 miles, including 286 bridges, during the month of November, at an estimated cost of \$122 million. In addition, \$3 million was authorized for preliminary engineering and \$12 million for right-of-way acquisition. Construction contracts were completed on 3,139 miles of these systems, including 547 bridges, during November at a cost of \$176 million.

Peak Water Use in Hartford, Conn.

The average daily consumption of water in Hartford, Conn., Water District for June, 1957, was the highest in Water Bureau history—59.92 mg. The maximum day was 68.2 mg. with peak rates of draft running to the rate of 95 mgd.



New! Oliver "Spot-Turn" Clutch Steering saves time, cuts costs

Oliver steps ahead with new "Spot-Turn" clutch steering—the finest combination of rapid maneuverability, operating ease and safety ever put into a crawler. Now you can make any kind of turn under a full load—sharp or gradual turns or complete rightaboutfaces.

The popular OC-12 crawler, shown above, has "Spot-Turn" clutch steering as standard. It's the big paying crawler in its class with power to handle a 1½-yd. loader, bulldozer or angledozer, or to pull rollers, scarifiers and scrapers.

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With its easy, time-saving "Spot-Turn" steering, the Oliver OC-126 loader is a top-speed materials handler. Choice of gasoline or diesel power.

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Knoxville 17, Tennessee

Major new development

THE CLOROBEN UP-SEWER CHEMICAL ROTATION METHOD

Here is an entirely new and remarkably effective way to eliminate conditions in sewage collection systems that cause local odor and grease problems, and which also adversely affect final treatments.

With the Cloroben Up-Sewer Rotation Method, accumulated grease deposits and slime formations are dissolved; high sulfide production eliminated.

The Cloroben Up-Sewer Rotation Method consists of two major steps. First a shock treatment of isolated local areas where excessive accumulation of grease and slime has occurred. Then, a preventive maintenance program using the principle of periodic shock dosing of local upsewer lines.

By shifting and rotating the upsewer dosing points, laterals, branch sewers, lift stations, wet wells and force mains will periodically receive an application sufficient to prevent any further excessive formation of grease and slime deposits.

Up-sewer treatment using the Cloroben Rotation Method gives any sewage collection system the same proven benefits enjoyed by many cities now using Cloroben. Cloroben dissolves accumulated grease and slime deposits in sewer lines, lift stations, wet wells, and force mains.

With Cloroben, sulfides are suppressed and odors eliminated. Roaches and mosquito larvae are killed. Corrosion of metal, brick and mortar is inhibited with resultant savings in labor and other maintenance cost.

The Cloroben Up-Sewer Rotation

Method will assure the delivery of a non-septic, stabilized influent to the final treatment plant.

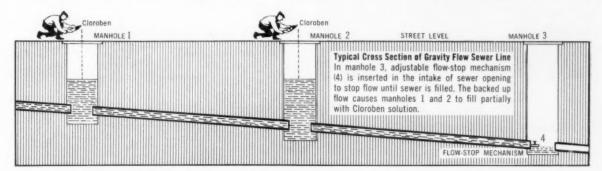
FREE: Technical bulletin, just prepared, gives complete facts about Cloroben Up-Sewer Chemical Rotation Method, includes directions for odor and grease

control, cleaning of wet wells, force mains and sewer lines. Write for your copy, without obligation.



CLOROBEN CHEMICAL CORPORATION

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USS American Welded Wire Fabric is used all over the world for sanitary and storm sewers, highway and railroad culverts, and for airport drainage.

It pays ... to ask, "is it Reinforced"

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New G-E "bonus-line" ballasts

Comparison proves dependability, efficiency, lower operating cost

When you buy General Electric's new outdoor lighting ballasts you'll be getting "bonus" features offered by no other manufacturer! Lower operating costs—General Electric ballasts mean less lighting maintenance and real dollar savings to you. You get improved lamp-current regulation, lower crest factor, and the delivery of rated wattage to lamp in horizontal position.

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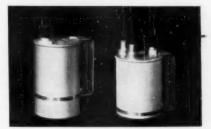
Higher efficiency—Wattage losses are reduced because highest quality grain-oriented steel is used in a new G-E core design to provide the most efficient ballast available!

There's no "or equal" to G-E "bonus-line" ballasts. And these extra values are yours at no increase in price! Call your G-E Apparatus Sales Engineer or Agent for details. And, when you do . . . ask about *all* the new G-E mercury products for 1959. General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C.

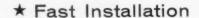
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| Watts Loss | 55 | 77 | 52 |
| Regulation | +0 to | +2 10 -2% | +1 10 |
| Crest Factor | 1.5 | 1.8 | 1.6 |
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Ease and speed of installation-with only one joint component, a double-sealing, dual-hardness rubber gasket-means economy from the start. Its deflection capability means additional economy.

Combined with the proven longer service life of high strength cast iron, the American Fastite Joint offers many special advantages for water, sewage and other liquid service.

Get full facts from your nearby American Cast Iron Pipe Company representative while your project is in the planning stage. Ask him about Fastite-American Fastite Joint cast iron pipe.

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How 2 cu. yd. Trojan handles all loading operations for Midland, Texas Plant.



Replacing another tractor shovel, this Trojan 154 gives a production boost to the ready-mix plant of West Texas Concrete Products, Inc. The precision control, fast travel speed and high capacity allow it to keep the batcher loaded and still handle truck loading, stockpile maintenance and other chores around the plant.



Trojan 154 digs in, moves material and charges batcher on a fast, continuous cycle.



Your TROJAN distributor can help you with the many advantages of YALE Financing plans, the most complete ever offered to equipment buyers . . . TIME PAYMENTS, LEASING PLANS (with or without OPTION TO PURCHASE) . . . exactly what you need to finance your new TROJAN machines.





TROJAN 154 BETTERS RATED CAPACITY— PROVES "INDISPENSABLE" IN READY-MIX PLANT OPERATION

High capacity and precision control were the features that sold West Texas Concrete Products, Inc. on the Trojan 154. They needed a fast operating machine with the ability to dump exact amounts of material into the batcher. This was no problem for the Trojan 154... But they required a machine with a $2\frac{1}{2}$ cu. yd. capacity. A trial of the 2 cu. yd. model 154 proved that the Trojan could better its rated capacity by $1\frac{1}{2}$ yd. load after load, day after day, and still maintain work cycles fast enough to allow it to handle other jobs around the plant area. "The Trojan 154 is a fast loading, fast travelling machine." says Mr. John Marlow, Plant Superintendent of the Midland, Texas Plant. "Its part in boosting the speed of our operation has meant considerable savings for us."

A loading operation for the Trojan tractor shovel involves carrying 6,000 lbs. of rock, 8,000 lbs. of regular sand and one load of fine sand — dumping the correct amounts into the batcher and returning the surplus to the stockpile. The batcher, in turn, dumps the mixture into the ready-mix truck. The fast loading cycles of the Trojan 154 help to complete this entire operation in six minutes.

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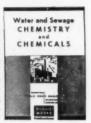
ENGINEERING

Water Supply and Purification By W. A. Hardenbergh

Among the major changes introduced in this latest edition are the following: The chapters on ground water, on filtration, and on laying pipe and maintaining lines have on laying pipe and maintaining lines have been almost completely rewritten; the chap-ters on pipe conduits and on disinfection have been revised to bring the material in them up-to-date; and a new chapter has been added on fluoridation. Design exam-ples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-1 on the coupon.

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Patching Pavements Properly

Designed as a general review for the top Designed as a general review for the top men and a practical guide for the men in actual charge of the work. Written in down-to-earth language for easy understanding and application. Fills a long felt need for a com-plete and precise patching article. All types of pavements and all kinds of patching material and equipment are described and il-lustrated in considerable detail. Among the many subjects discussed are the general causes for failure; the various materials and equipment used in patching; and the process making the patch. To order your copy circle number A4.



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ALGAE of Importance in Water Supply

This major article was prepared in close collaboration with U.S. Public Health service authorities. It includes, for the first time in magazine history, full and accurate color plates for the identification of types of algae most important in water supplies—those which cause taste and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification. To order your copy A-5 circle A-5 on the coupon.

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By W. A. Hardenbergh

An authoritative yet simple treatment of the subject by one of the nation's foremost au-thorities. Mr. Hardenbergh's editorial and field work has brought him in close contact with the problems that trouble the average engineer and in this book he explains those methods most suitable for general use. Special attention is paid to sewerage systems, both storm and sanitary. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-6 on the coupon.



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The Operation of Sewage Treatment Plants

This valuable text has been completely revised, expanded and brought up to date. In it all phases of Sewage Treatment Plant operation are treated in simple, easily understandable language. Among the many subjects standable language. Among the many subjects covered are: measurement flow; concentration and temperature; sampling sewage for analysis; laboratory determinations; purposes of treatment; operation of grit chambers; operation of screens; trickling filter operation; filter fly control; disposal of sludge; etc. To order your copy circle A-7 on the A-7 coupon.

The Operation of Water Treatment Plants

Here in one place you have the basic information concerning all phases of plant operation. Even those without previous technical school education will find it easy to learn from this valuable text. Completely revised, expanded and brought up to date by Clayton H. Billings, Associate Editor of Public Works. This reprint is of special interest to Water Works Superintendents, Water Treatment Plant Operators and everyone connected with the Water Works field. To order your copy circle A-8 on the coupon.



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One of two Permutit Automatic Valveless Water Filters at O. M. Scott & Sons Co. Chemical Products Plant, Maryswille, Ohio. Each filter is T diam. and rated at 116 gpm. The complete Permutit water-treatment system was engineered by H. A. Williams and Associates, Columbus, Ohio.

"No maintenance or operating expense with our PERMUTIT Valveless Filters"

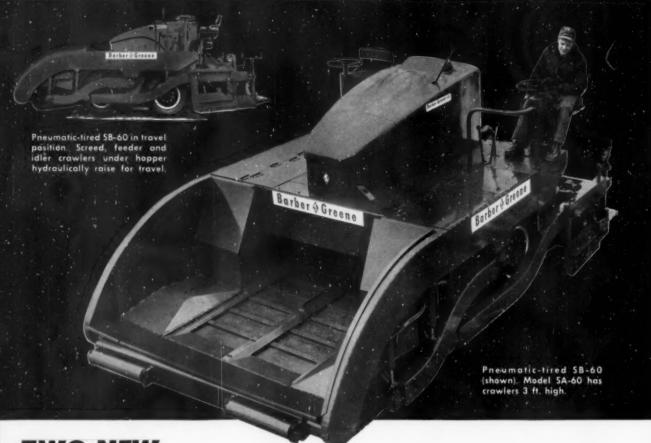
- These filters have been operating continuously for over a year and a half ... supplying water for process, boiler feed and drinking. They follow a Permutit Precipitator that treats raw well water with lime, soda ash and coagulants. Either filter can handle full feed rate during inspection or repairs on the other.
- Here's how Glenn L. Moll, Scott's Service Manager, puts it: "Our Permutit Automatic Valveless Filters are operating very satisfactorily. The filterbed and underdrain system stay clean with no evidence of blow holes or sifting of filter media to the underdrain system. We now inspect them only twice a year."
- The Valveless Filter is completely automatic—yet costs up to 45% less than conventional automatic gravity filters because it uses no expensive valves, flow controllers, pumps or hydraulic or pneumatic control systems.

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CRAWLERS or PNEUMATICS

Model SA-60

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Designed throughout for heavy-duty, high-capacity, low-maintenance operation, these two new Barber-Greenes offer the ultimate in high-tonnage production. They reduce nonproductive time, lay more miles per day at less cost per ton.

New design concepts give unequaled speed and maneuverability... 100% power steering (no clutches—no steering axle)... faster truck contact, discharge and release . . . feeder and screw speeds independent of travel speed . . . new automatic feed control . . . articulated, stabilized suspension . . . new unitized-construction . . . improved automatic leveling . . . hydraulically operated, high-speed tamper.

FOUR DIFFERENT FINISHERS. Only Barber-Greene offers a line of four finishers: the new 873, which paves on crawlers and travels on rubber; the new heavy-duty SA-60 and SB-60, shown above; and the famous 879-B unmatched for all types and sizes of jobs.



Self-cleaning, hydraulically operated hopper extends to extreme rear of chassis where gates are located.

These are just the high spots. Ask for complete information.

59-1-F

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CONVEYORS...LOADERS...DITCHERS...ASPHALT PAVING EQUIPMENT

PUBLIC WORKS

Magazine

MARCH 1959 Volume 90 Number 3

AFTER scarifying, the base is widened to 16, 18 or 20 ft.; depending on the thickness of the old base, bank-run or crusher-run gravel is added to obtain the desired 18-in. depth of foundation.



A Rural County's 10-Year Road

RECONSTRUCTION PROGRAM

ROBERT A. REED, County Highway Superintendent, Steuben County, New York

L ARLY in 1958, the Steuben County Highway Department and its Highway Committee presented its Board of Supervisors with a Special Report which summarized the prevailing conditions of the County Highway System and recommended a road construction program for the next 10 years at a total estimated cost of \$12 million. We are presently ahead of our anticipated work schedule, according to our Program.

The report indicated that the County Highway System is composed of the following mileage of roads: Plant mix, 6.63; penetration, 642.32; road mix, 1.34; gravel, 20.09; and unimproved, 18.12. This represents a total in the system of 688.50 miles.

Of this total we considered 191.69 miles adequate as to type and width

of construction. However, we estimated 156.15 miles of the 191.69 will require additional topping to improve the wearing surface. Most of this work is scheduled for mileage which is now 18 ft. in width; the balance is either 16 or 20 ft. in width.

In our 10-year Program we estimated that the retopping of the necessary mileage will be completed by the end of 1963. It will cost approximately \$1.8 million. This is based on an estimated cost of \$15,000 per mile for plant-mix material and \$8,000 per mile for double honing. We have planned 79.89 miles at \$15,000 per mile and 76.26 miles at \$8,000 per mile.

Reclamation of Bituminous Surface

The most significant part of our 10-year construction program is the mileage of old bituminous surface which we have scheduled for rebuilding. This aggregates 354.75 miles and is composed of 47.24 miles

20 ft. wide; 253.64 miles 18 ft. wide; and 53.87 miles 16 ft. wide.

Based on current cost, we estimated that this work will average approximately \$13,000 per mile for base construction, and total construction costs are estimated at \$34,000 per mile. These costs are based on various possible methods of construction, all of which have their place in our County Highway System. All work is done by our own forces.

Of the total 354.75 miles scheduled for reconstruction, we are planning to complete an average of 35 miles per year for the next 10 years. We are following three different methods of construction, depending on present road designs, 16, 18, or 20-ft. travel surface with an 18-inch gravel base and 5-ft. shoulders.

Much of this mileage was constructed before 1930, and presently exists as 10-ft. bituminous macadam roadways. Our base construction is conducted with the purpose of obtaining a stabilized base for approximately 18 inches, with calcium chloride used as a compaction aid throughout the top 6 to 8 inches.

Construction Procedure

After survey and design, the old roadways are scarified. The base is widened by trenching to the desired width, 16, 18, or 20 ft. Depending on the thickness of the existing base, additional courses of bankrun, and crusher-run of bank gravel are added until the desired 18-inch thickness is achieved.

A minimum of 12 inches of bankrun or fieldstone material is desired, and 6 inches of crusher-run of bank material. An application of from 2 to 4 tons of calcium chloride is applied to hold the fines and to bind the materials together for the subbase.

Then two courses, a minimum of 3 inches each, of crusher-run of bank gravel are placed. After compaction of each 3-inch course of crusher material, calcium chloride is applied uniformly by mechanical spreaders. This then gives us a stabilized base of approximately 18 inches with calcium chloride throughout the top 6 to 8 inches.

Our specifications for base material consists of 57 percent stone, 38 percent sand and approximately 5 percent silt, and we try to obtain an 18-inch depth in all bases. During the base work, we roll with a rubber-tired 8 to 12-ton Bros roller and final rolling is made with an Austin-Western 10 to 12-ton three-wheel steel roller.

We find calcium chloride desirable as it binds the entire base together and produces a most satisfactory road. In the final analysis, from 12 to 14 tons of calcium chloride per mile are used during construction in the first year.

Where there are heavy fills, the bituminous macadam surface is not added until the second year; this procedure allows the traffic further to compact the road to desired density, and also enables us to determine and eliminate any weak sections while the road is curing out during the first year.

We have found that the public is satisfied with the elimination of dust and we, of course, are pleased with the ability of calcium chloride to hold the fines in the surface while the base is curing preparatory to the addition of bituminous macadam.

Surface Course

Following the base construction we use three types of top which are:

1) Gravel mulch, followed with a plant-mix surface; 2) a 1½-in. pen-



■ TYPICAL completed section of new-type road is big improvement over original 10-ft. surface. This is 20 ft. wide, on 18-inch gravel base, with 5-foot shoulders.



WORKMEN are unloading calcium chloride from bags into a work truck, a method now practically eliminated. Calcium chloride is now shipped in bulk directly to the bins, at a saving of about \$12 per ton, half of which is due to reduced labor costs.

etration top, followed with a series of honing, or retread surfaces to build up the thickness; and 3) the plant-mix top of a minimum of $2\frac{1}{2}$ -in. thickness.

In allocating the improvement in our County Road System, we followed a 10 point priority system. The points of this system are as follows: 1) condition of the road; 2) traffic count; 3) connecting link with other roads; 4) meeting with reconstructed county roads at county line; 5) State Department of Public Works requests; 6) snow and ice control conditions; 7) right-of-way difficulty; 8) bridges; 9) industrial conditions; and 10) committee recommendations.

These points are followed wherever feasible, but we realize that there are no hard and fast rules for improving or reconstructing roads. Too many elements enter into the picture in each case.

We should mention the equipment we have obtained and have had available for our road reconstruction program. Other new (replacement) equipment is scheduled to be purchased later but our present equipment for road reconstruction includes the following items.

Four Caterpillar D-6 dozers with angle dozer blades that have 75 draw bar hp, with three of them equipped with winches for tree removal.

Ten Austin-Western four-wheel-drive graders. Each of these is equipped with bulldozer blades and scarifiers; and they also have snow-plows, V-type or one-way plows, with snow wings.

Three 3/4-cubic yard shovels, two are P & H, and one Northwest. We work two crushers off one shovel and presently are using three Austin-Western crushers with 2x4, 3x6, and 2x6 screens.

We presently have 15 Brockway highway trucks, 7½-ton capacity, equipped with 5-cubic yard boxes, and Frink 9-ft. V-type plows and 10-ft. wings for winter maintenance work. Our 20 maintenance trucks are 2-2½-ton dump trucks—International, Ford and Chevrolet. We have 8 Jet Queen spreaders of the box type, permanently mounted with 5-cubic yard boxes. These spreaders are used on Ford and Chevrolet trucks, along with 10-ft. one-way Burch snowplows.

We have 15 Tarco Scotchman spreaders, tail gate type, used for spreading straight chemicals and have 40 Whirligig trailer type Burch and Good Roads spreaders. We load our materials with six Scoopmobiles of 1½-yard capacity. Our tractors



SPREADING calcium chloride as a surface application to save road materials, reduce dust and improve compaction, pending curing of base and construction of top.



STORAGE bin was fabricated from steel sheeting and used railroad iron. It
 will store approximately 125 cubic yards of materials for winter maintenance use.

consist of International and Ford models, and we have a total of 15 at present, with front end loaders.

In our 10-year Program of road reconstruction in Steuben County, we hope to complete what we consider our four point program which consists of 1) reconstructing 354.75 miles; 2) surface treatment and maintenance of 126.30 miles (now under 16-ft. in width); 3) top a total of 156.15 miles which is already constructed; and 4) keep our bridge reconstruction in pace with the road construction and weight limits.

Material Storage

We should like to mention our bins for storing winter maintenance materials. We recently completed two 125-150-yard capacity storage bins made of scrap metal at a cost of about \$1,000 each. We are proud to state that each of these was built in five days by four men. These bins will be used for storing bulk chemicals.

We recently converted from 95 percent bag to 95 percent bulk handling and storing of chemicals, and we have realized a saving of \$6 per ton by eliminating bags, and another \$6 per ton in labor savings. We have applied this saving to the purchase of additional chemicals for winter maintenance work, which we use directly and with abrasives.

Our storage sheds were built from old steel sheeting and used railroad rails, no longer adaptable for bridge work. We bolted and welded this material together and now have two most suitable storage sheds for materials.

COMPLETE TREATMENT PLANT

Designed

FOR MOUNTAIN RESORT CITY

V. A. VASEEN, President, Ripple & Howe, Inc. Denver, Colorado

THOUGH showing no recent growth, Salida, Colo., with a present population of 5,000, has a great potential for the future. A mountain community on the Arkansas River, a tourist resort for both winter and summer vacationers; with excellent hunting, fishing and winter sports facilities almost within walking distance of the city. The famous FIB-ARK boat race (FIB-ARK means First in Boating Arkansas River Club) is held each spring at Salida. There are also large mineral deposits, including feldspar in close proximity. It would take only minor changes in need for these minerals to influence drastically the future growth rate of the community.

The firm of Ripple and Howe, Inc., was retained by the City of Salida as far back as 1954 to study the local problems and to prepare plans and specifications for the construction of a complete sewage treatment plant.

Portions of the sanitary sewer system of Salida were constructed as much as 38 years ago, possibly with the thought of picking up enough infiltration to assist in keeping the sewer lines clean. Consequently, when the ground water table is high, the sewage flow is about 300 gallons per capita per day.

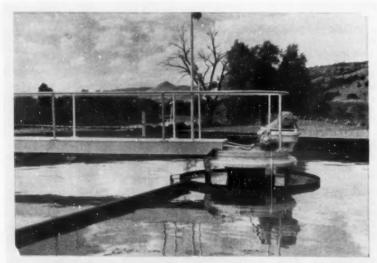
After the basic design of the plant was crystallized by the consulting engineers, the City was advised to advertise for and receive the equipment bids, make the selection of the equipment and furnish the equipment to the general contractor for installation. Contracts were awarded to Dorr-Oliver for the primary clarifier mechanism, 45-ft. diameter and 6-ft. depth; the high rate trickling filter distributor for a filter 106 ft. in diameter and having 4 ft. of stone; and the sec-

ondary clarifier mechanism, also 45 ft. in diameter and 6 ft. in depth. The Pacific Flush Tank Company was awarded a contract for a 125 .-000-Btu heat exchanger. A 75-gpm, 100-ft. head, piston type sludge pump was purchased from Ralph B. Carter Co. The Chicago Pump Company furnished a Barminutor, Model "B", bar screen and grinder and a floating cover for a digester having a diameter of 45 ft. The American Well Works supplied two horizontal raw sewage pumps of 5 hp. each (375 gpm at 21-ft. tdh). Fischer and Porter Company supplied a fully automatic chlorinator and accessories rated at 200 to 10 lbs. per day.

While the project was under way it was decided by the city that an application should be made for a federal grant. Therefore, in Decemequipment and the construction of the sewage plant were received by the City in June, 1957, from eleven different contractors. An award of \$131,130 was made to the Butala Construction Co. of Salida, Colorado. The plant was completed in June 1958.

The location of the plant as chosen by the engineers necessitated the addition of 1½ miles of 15-inch outfall sewer along the west bank of the Arkansas River to a point just opposite the plant location where a river crossing was made.

The sewage passes through the bar screens and comminutor, and thence through dual channel, manually cleaned grit chambers and is pumped to the primary clarifier, which has a design detention of two hours. The effluent thence flows by gravity to the trickling filter



PRIMARY clarifier is 45 ft. in diameter with sidewater depth of 6 ft.
This is followed by a high rate trickling filter and by secondary settling.

ber, 1956, the city applied for a grant of \$81,730.38 with funds to be furnished by the City of Salida amounting to \$190,704.22. The request was successful.

Bids on the installation of the

which is now operated at a standard rate but could be converted to a high rate filter. The filter is followed by the secondary settling basin with a calculated 1½ hours' detention and by chlorination at

about 15 mg/L with 15 mins. detention at design flow. The effluent is then discharged into the Arkansas River.

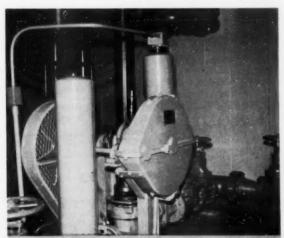
Only primary clarifier sludge is pumped to the primary digester (approximately two minutes out of each hour); the supernatant liquor from both the primary and secondary digesters goes back to the raw sewage lift station. The secondary clarifier sludge is removed continuously to the raw sewage lift station through an automatic control valve and is thus allowed to settle in the primary clarifier. Provisions have been made to pump the secondary clarifier sludge directly to the digester, if so desired.

To protect the plant, an overflow weir has been constructed in the channel of the grit chambers which will allow raw sewage to discharge to the Arkansas River in the event of power failure at the plant. An infiltration type, non-potable water supply was installed to furnish water for the heat exchanger, laboratory sinks, and sanitary facilities within the plant, as well as for washing down the plant structures.

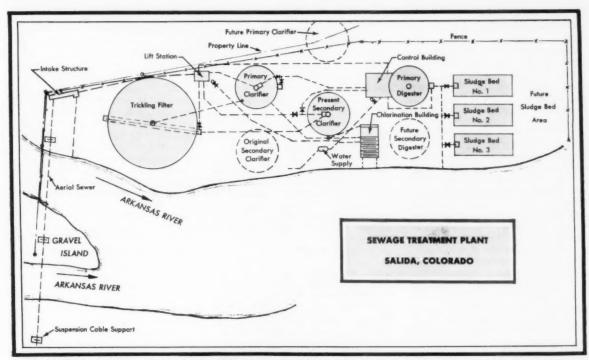
The City of Salida and its officials including: Robert J. Brazil, Mayor; Councilmen Ray Adams, Glen Ayres, Harriet Alexander, Ralph Cupelli, A. M. Macartney and Stewart Sexton; City Clerk Theodore J. Judge; and Water Superintendent, C. L. Glenn, were most helpful in solving the many problems incident to the design, financing and construction of this modern plant.



CLOSE-UP view of distributor showing the rock media. Filter is single stage, 106 ft. in diameter.



 SLUDGE pump: Primary sludge is pumped to primary digester approximately two minutes during each hour.



■ LAYOUT of sewage treatment plant. Units in color represent portions of plant in operation at the present time.

HOW SAFE IS YOUR CHLORINE RESIDUAL?

WATER resources vary considerably in chemical and biological character. Quantitative and qualitative variations depend on many factors and obviously are related to the environmental conditions that precede the delivery of water. Conventional forms of treatment, where employed, alter materially the chemical and biological composition of water. Chlorination, in particular, exerts a positive influence on the biological flora and is employed to yield a potable, esthetically desirable commodity.

Basically, biota of sanitary significance in water are either pathogenic (disease-producing) organisms or nuisance-producing organisms. Each group includes both plants and animals. The significance of the presence of pathogens in water is apparent, but the economic effects of nuisance organisms sometimes are less apparent and more difficult to evaluate. Chlorination, properly employed, provides a safe and effective means of eliminating all of these considerations; unfortunately, however, the art and science lack satisfactory definition in some cases. The purpose of this article is to point out some of the common pathogenic biological inhabitants of water and their significance and to evaluate the status of current knowledge of their control by chlorination.

Significant Organisms

Pathogenic organisms discharged in human feces often find their way into water. These organisms may survive for weeks at temperatures near 20°C or for months at lower temperatures. The survival period in water depends on such environmental, physiological and morphological factors as pH, temperature. oxygen and nutrient supply, dilution, competition with other organisms, resistance to toxic influences, ability to form spores and others. Whether they actually cause disease in man, of course, depends on such factors as their virulence, concentration, and ingestion by and resistance of hosts.

Disease-producing organisms that merit consideration in connection EDMUND J. LAUBUSCH, S.M.

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with chlorine disinfection include: Vegetative intestinal bacteria, e.g., Eberthella, Salmonella, Shigella, Vibro; intestinal protozoa, e.g., Endamoeba histolytica, Histoplasma capsulatum; worms, e.g., blood flukes, Schistosoma; and viruses, e.g., Coxsackie, hepatitis, poliomyelitis.

Bacteriological control of water does not routinely involve identification of specific disease-producing organisms. Instead, water is examined for coliform bacteria, normally considered harmless.* In the absence of simplified, more specific biological tests for pollution, and pending demonstration of other more satisfactory indicator organisms and technics, the coliform test remains the primary conventional index of bacteriological quality and safety.

The use of the coliform index is based on two premises. Disease-producing organisms are equally or more susceptible to natural or artificial destructive powers (self-purification and disinfection); and the presence of coliform organisms in small amounts of water suggests the possible presence of excretal pollution. Similarly, the absence of coliforms is considered as a criterion of probable safety.²

*Not all coliform organisms as currently defined¹ are of intestinal origin; Escherichia coli strains usually are, but intermediate and Aerobacter strains usually are of soil, vegetable or other non-fecal origin. The sanitary significance of the various types of coliforms appears to be insufficiently established to warrant routine laboratory differentiation, although this is not universal practice.

The utility of the coliform index and of recognized bacteriological standards of acceptable drinking water quality and the effectiveness of water treatment processes are amply demonstrated by the decrease in the incidence of bacterial water diseases accompanying their adoption. Notwithstanding this and their almost universal use in this country, the real significance, precision and validity of the coliform test and standard is a subject of considerable controversy.3 Increasing attention on water as a vehicle in the possible transmission of non-bacterial diseases suggests even greater scrutiny.

Chlorination practice to insure a bacteriologically-safe water is based, in part, on the belief that Salmonella typhosa, the causative bacterium of typhoid fever, is at least as vulnerable to chlorine as coliform organisms; and, further, that its vulnerability is fairly representative of that of other intestinal Salmonella and Shigella (dysentery) pathogens. It has been reported, however, that coliforms die off naturally more rapidly than some enteric pathogens and that some strains of Salmonella, Shigella, M. tuberculosis and other organisms are more resistant to chlorine under certain conditions.4 Furthermore, attenuated and slow lactose-fermenting coliform forms apparently resistant to conventional chlorine treatment are considered by some to be of sanitary significance. Accordingly, research is indicated to examine and revaluate current criteria of disinfection and satisfactory drinking water quality. Various observations on the resistance to chlorine of these and other enteropathogens follow.

Factors Influencing Disinfection

Important among the factors affecting the survival of pathogens in water insofar as disinfection is concerned is their natural or imposed (e.g., encasement in algae, suspended materials, tubercles etc.) resistance to toxic influences such as chlorine. Each group of organisms differs in this regard. Moreover, there is considerable variation in the behavior of different species within

individual groups, and some evidence that the characteristic reaction of different organisms to chlorine is not necessarily maintained relative to other organisms of that species.

The efficacy of chlorine disinfection of water is influenced by these major variables: ⁵ 1) Amount and type of chlorine present, and equilibrium; 2) relationships between coexistent chlorine forms (a function of pH); 3) presence of chemical and other chlorine-demanding complexes; 4) duration of contact; 5) temperature; and 6) type and density of bacteria, virus, algae, protozoa and other microorganisms and their susceptibility to chlorine.

Type and Form of Available Chlorine. Because of the known rapid disinfection rate of free available chlorine as OCl— and especially HOCl in contrast to combined available chlorine, a distinction must be drawn between the required disinfecting concentration of either type and the primary form in which the

combined form as monochloramine, diminished bactericidal reductions are apparent and are especially pronounced if coupled with low temperature conditions. In general, low pH accelerates, and the presence of ammonia, amino and other organic materials diminishes the bactericidal potential of available chlorine in free or combined forms.

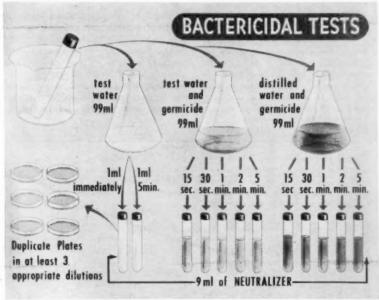
Chlorine Demand. Many chemical and biological substances that occur in ground or surface waters have an affinity for chlorine. These substances are oxidized by chlorine, the extent and rate of reaction depending on the oxidation-reduction potential of the system, pH and other factors. Since they utilize chlorine for oxidation, their presence and concentration must be considered in satisfying the chlorine demand and establishing requirements for disinfection. When it is necessary to operate beyond the chlorine breakpoint to ensure destruction of disease or nuisance-producing organisms, the amount of chlorine reContact Time. When chlorine is added to water it will react to form free available chlorine:

This condition does not persist, however, since the chlorine existing as HOCl and OCl- above about pH 3.0 almost instantaneously reacts with ammonium ions to form mono- and dichloramines, nitrogen trichloride or ammonia, depending on pH. Some of the chlorine also combines with organic ammonia and amines to form organic chloramine complexes. Not until the demand from these sources has been satisfied will residuals again exist as free available chlorine (i.e., beyond the breakpoint). Since the effectiveness of disinfection depends on the amount and kind of available chlorine, it follows that the contact time provided also is an important consideration. In general about 100 times longer contact is required for combined available chlorine in contrast to an equivalent amount of free chlorine under the same conditions to effect equivalent bacterial kills.7,9

Temperature. Butterfield et al^{7.8} report that the effects of temperature upon the bactericidal efficiency of free chlorine is most marked at pH \geq 8.5 where the overall rates of kill decrease; the effect at pH 7.0 to 8.5 is not marked. The effects also are pronounced where free chlorine residuals are very low, in the order of 0.02 to 0.03 ppm.

Butterfield⁶ also reported on the effects of temperature on the bactericidal efficiency of combined available chlorine forms. At pH 7.0, about two and a half times as much combined available chlorine is required for comparable rates of kill at 2° to 4°C as at 20° to 25°C; at pH 8.5 about one and a half times as much is required. Some authorities suggest that the influence of temperature on bactericidal properties of chlorine may not be as significant as these data imply.

Importantly, then, organism resistivity to chlorine penetration and inactivation or destruction differs with chlorine concentration and type, contact time and temperature, as well as individual susceptibility to toxic influences. To ensure disinfection with chlorine it is necessary to effect a suitable combination of available chlorine, contact time and temperature, demonstrated locally, by experiment and experience, to achieve the desired objective. Thus, necessary free or combined available chlorine residuals must be defined in terms of a mini-



Courtesy Robert A. Taft Sanitary Engineering Center

 METHOD of testing the bacteriological efficiency of a disinfectant. Disinfectant solution containing bacteria is neutralized at different time intervals and plated.

chlorine exists. The latter is a function of the pH. According to Butterfield and others ^{6,9} about 25 times as much combined available chlorine is necessary to obtain equivalent bacterial kills (S. typhosa) as free chlorine under the same conditions of pH, temperature and contact time.

At higher pH levels when chlorine exists primarily as OCl-, or in the

quired for chemical oxidation may be substantial.

It should be noted that some chloro-addition or substitution products, although lower in oxidation potential than free chlorine and inorganic chloramine forms, do exhibit bactericidal properties. Their effectiveness, however, is comparatively insignificant under the usual conditions of chlorine disinfection.

mum attainable contact time for the conditions prevailing at the facility in question, and for the most resistant organisms for which control is aimed.

Various observations on the resistance to chlorine of common pathogens follow.

Enterobacteria

Not all intestinal organisms normal to warm-blooded animals and man are pathogenic. With the exception of cholera, practically extinct in this country, the known water-borne intestinal diseases (typhoid, paratyphoid and gastroenteritis) are caused by Salmonella and Shigella organisms. Diseases such as tuberculosis, anthrax, tularemia, and streptococcal or other bacterial infections in man might also be water-borne. Except for the enteric pathogens, however, most disease-producing bacteria do not often occur nor normally survive long in water. Furthermore, isolation of such organisms in heavily polluted water does not establish the certainty, in the absence of supporting epidemiological data, that the diseases they produce are water-borne

Salmonella. The organisms of primary interest in this genus are S. typhosa (typhoid fever), S. paratyphi and S. schottmuelleri (paratyphoid). In their classical investigations on the bactericidal action of chlorine, Wattie and Butterfield.9 concluded that at pH 6.5 and 7.0 typhosa strains are consistently more resistant to chlorine than coli strains; at pH 7.8, coli strains are more resistant with concentrations of free chlorine in excess of 0.03 ppm; and at pH 8.5 or better, all strains of E. coli (tested) are equally or more resistant than S. tuphosa strains. These differences appear less pronounced when chloramine is the bactericidal agent. Thus, isolated cases of typhoid can be transmitted by water actually conforming with present coliform standards, but explosive epidemics are improbable where conventional water quality objectives are attained.

There is some evidence that Salmonella organisms may be involved in gastroenteritis* although the etiology of such water-borne diarrheal diseases has not been definitely established. Some believe that most such disorders really are mild cases of dysentery caused by Shigella organisms; others hold that unclassified bacterial organisms, viruses

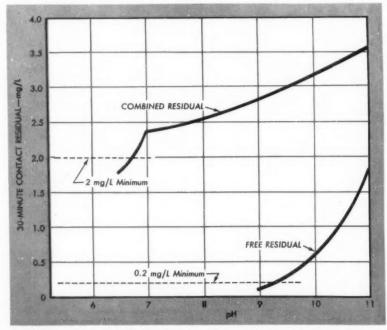
or blue-green algae are involved.² The causative organism(s), and the minimum lethal chlorine dose, remain to be defined. Conventional bacteriological water quality standards, then, do not necessarily provide assurance of potability in this regard.

Shigella. The organisms of primary interest in this genus are S. dysenteriae and S. paradysenteriae both of which are responsible for paratyphoid in man. Relatively little appears to be known about the resistance of these organisms to chlorine but it is believed that they are similar to S. typhosa in this regard.^{2,9}

Others. While direct contact is the usual means of transmission of tularemia, apparent water-borne epidemics of the disease in man have been reported. The author is not aware of any conclusive evidence of human infection of tularemia transmitted by naturally contaminated water, although the causative bacteria have been isolated10 in certain streams in Montana that are sources of water supplies; direct contact is the most usual means of transmission. Foote et al.10 demonstrated that the causative bacteria, Pasteurella tularensis are susceptible to chlorine and reported a series of experiments in which they were rendered harmless by solutions of chlorine gas or hypochlorites in water treated to a residual of 0.2 ppm (total) in 30 minutes. The minimum lethal dosage apparently has not been defined.

It is well established that human tubercle bacilli are much more resistant to chlorine than coliforms and other common, non-spore forming sewage-bearing organisms. 11.12 Using a pure culture of M. tuberculosis (hominis) in sterile and natural sewage, Heukelekian and Albanese11 observed that a (total) chlorine residual of 1.0 ppm after 30 minutes' contact (orthotolidine method) resulted in about a 40 percent reduction of M. tuberculosis, and in a 99 percent suppression of saprophytes. These observers recommended that chlorination to a residual of 3 ppm after 30 minutes' contact, or to a residual of 1 ppm after 60 minutes' contact, is required for effective destruction of tubercle bacilli. Greenberg and Kupka¹³ recommend a chlorine dose of at least 20 ppm and at least 2 hours' contact to control tubercle bacilli in a well oxidized sewage treatment effluent. At the present time, poliomyelitis does not meet the epidemiological criteria of a water-borne dis-

Heicken¹² reported that resistance to free chlorine and chloramine increase in this sequence: *E. coli*, staphylococci, tubercle bacilli and anthrax spores, but that the differences in the effect of chloramines are less. He also noted that chloramine acts much more effectively against anthrax spores than free



GUIDE to bacteriological safety in using chlorine, after Snow⁵. Minimum free and combined residuals for bactericidal doses at different pH values and 0 to 25°C.

^{*}The name applied to a variety of nonspecific diarrheal or gastrointestinal disorders that can not be diagnosed.



Courtesy Robert A. Taft Sanitary Engineering Center

 RESEARCH with highly infectious agents requires elaborate equipment for the protection of personnel. This safety hood prevents physical contact with an agent.

chlorine. Friberg and Hammar-strom¹⁴ reported that exposure for 1 min. to a free chlorine residual of 0.025 to 0.05 mg/L effected a thousand-fold reduction in the number of typhoid and coliform bacteria at pH 7.2 and 6°C, but that a concentration of 0.10 to 0.15 mg/L is necessary to effect the same reduction of S. typhimurium, Streptococcus faecalis and Staphlococcus aureus.

Intestinal Protozoa

The most recent water-borne outbreak in this country of amebiasis or amebic dysentery, caused by cysts of Endamoeba histolytica, occurred in 1955.15 Although the low incidence of this disease provides some degree of public health assurance, it is important to note that at concentrations normally employed chlorine is ineffective in the destruction of these cysts (however. they are removed by effective filtration). Accordingly, the bacteriological coliform standard is of no significance in appraising a water supply from the standpoint of incidence of amebic dysentery where chlorine disinfection is the only treatment provided.

Chang and Fair16 report that chlorination of water having a pH of approximately 7.0 with doses sufficient to yield a residual of 1.0 ppm at 20°C to 2.0 ppm at 10°C after 30 minutes' contact will effectively destroy the organism. Becker et al.17 observed, however, that the cysts remained viable after 30 minutes' exposure to concentrations of chlorine up to 10 ppm and, in one case, viable cysts were isolated after 60 minutes' exposure at that dose. Chang and Kabler¹⁸ also observed that the presence of 1.8 to 2.4 ppm of free chlorine at pH 8.4 and at room temperature exerted no detectable harmful effects on the cysts

during contact periods of 100 min. or less.

Histoplasma capsulatum, the causative organism of histoplasmosis in man in of interest in many sections of the country. According to Metzler et al.19 spores of this fungus that infect water supplies are readily removed by conventional water treatment processes even without chlorination. Where no other treatment is provided, relatively long contact times and high chlorine dosages are reported necessary for adequate fungicidal action: at 26°C and pH 7.4, 0.35 ppm free chlorine and four hours' contact, or 1.8 ppm free chlorine and 35 minutes' contact are required.20

Worms-Blood Flukes

Schistosomiasis is a serious health problem in many areas of the world. The possibility of its introduction and spread in this country is increased by the immigration of persons from areas where the disease is endemic. The disease is produced by a blood fluke such as S. mansoni (prevalent in Puerto Rico and the Caribbean) which lives in human abdominal veins and expels eggs through the urine or feces. Within a few hours after discharge into fresh or brackish waters, the ova mature into miracidia which escape, seek and penetrate a snail host. Cercariae develop in the snail in about 28 days after, which they emerge. The disease is most often contracted by wading, swimming, or working in water courses infested with these cercariae; it is thought, however, that transmission by ingestion is possible.

Control is best accomplished²¹ by breaking the life cycle of the schistosome through environmental control, the principles of which include preventing discharge of schistisome ova into water courses;

ridding streams and ditches of snail hosts; killing cercariae; and protecting exposed populations from contact with infested waters. Protection of water supplies and proper disposal of sewage are fundamental. Ordinary rapid sand filtration and conventional sewage treatment processes are not effective in the removal or destruction of schistosome ova or miracidia. Ridding streams of snails can be accomplished by maintaining clean channels and flow velocities of 20 to 60 ft/min. According to Biaggi and Pirazzi22 a chloramine concentration of 0.45 ppm inactivate miracidia in an average of 7 to 8 minutes.

Treatment of infested streams to destroy either or both the cercariae and snails has been attempted but without marked success. Chlorination appears to provide the most effective treatment of drinking and bathing waters but its application to streams or other uncontrolled waters is not practical. Gonzales et al.23 recommend a minimum chlorine concentration of 0.50 ppm for 20 min. to render cercariae non-infective. These investigators observed that a chlorine concentration of 0.2 ppm had no definite effect on the cercariae. This does not support Magath's24 results and conclusion that sufficient chlorine to give a 0.2 ppm chlorine residual (presumably combined) after 30 minutes' contact will render water safe from pollution by the cercariae.

Enteroviruses

Several water-borne enteric viruses have been associated with human disease. Among those are Poliovirus, Coxsackie, Adenovirus, and ECHO (enteric cytopathogenic human orphan virus).25 The etiological significance of the presence of such viruses in water as a result of pollutional discharges remains to be established. It is important to note, however, that conventional coliform indices of sanitary quality are unsuitable for ascertaining the absence of viruses from water since enteric viruses generally are more resistant to chlorine than coliforms and enteric pathogens.26,27

Infectious Hepatitis. The incidence of infectious hepatitis in this country appears to have increased significantly during the past decade or more. Clinically almost indistinguishable from serum hepatitis, but different as to the etiological agent, mode of transmission, morbidity and immunity conferred, infectious hepatitis clearly is recognized as a disease of environmental significance. Reports of epidemics are recorded

wherein drinking water was established as the vehicle of disease transmission, and numerous others are recorded where it was highly suspect. 26-30 It is very likely that water-borne hepatitis occurs more frequently than is reported, especially in rural areas. Proof is lacking largely because laboratory tissue culture technics have not yet been successfully developed.

One of the most explosive outbreaks, between 20,000 and 40,000 cases, occurred in New Delhi in 1955-56. It is significant to note that this is the first known outbreak involving a treated water supply. Treatment of river water containing about 50 percent sewage is said to have been sufficient to yield a coliformfree supply.26 Reports on the outbreak are vague, however, and no evidence has thusfar been presented which clearly establishes the extent and efficacy of treatment provided at the time of the outbreak. This incident does not support the conclusions of some observers regarding the inadequacy of conventional water treatment practices in the removal or inactivation of the causative virus of infectious hepatitis.

Neefe and Stokes³¹ on the basis of studies using human volunteers, report that complete control of the causative hepatitis virus in drinking water depends almost entirely on the proper use of a suitable disinfectant, as the virus is not destroyed or inactivated by coagulation, settling and (diatomite) filtration. The addition of chlorine to provide a 30-min. free residual of 0.4 ppm (1.1 ppm total) to a coagulated, settled

Table 1—Chlorine Required to Destroy Coxsackie Virus (Clark-Kabler)

| | | Time | Free Chlorine | |
|-----|------------|------|------------------|--|
| pH | Temp. | Min. | mg/L | |
| 7.0 | 3° - 6°C | 5 | 1.4 | |
| 7.0 | 27° - 29°C | 3 | 0.5 | |
| 9.0 | 3° - 6°C | 10 | 4.0 | |
| 9.0 | 27° - 29°C | 3 | 1.0 | |

and filtered water apparently was sufficient to inactivate the virus under the test conditions; however, provision of the same available residual in a contaminated water that was not pretreated did not affect the virus, although breakpoint dosages apparently were viricidal. On this basis alone, it would appear that the treatment provided at many water plants is inadequate insofar as inactivation of this virus is concerned.

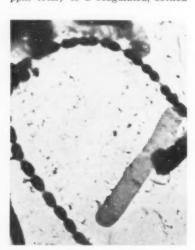
Poliomyelitis. Recent progress in the development of an effective poliomyelitis vaccine has minimized considerably the dread associated with this disease. The fact is, however, that practical extinction of the disease has not yet occurred. Moreover, abortive polio cases doubtless occur in far greater numbers than the total number of paralytic cases reported. Considerable research has been conducted to establish the epidemiology of poliomyelitis. Water has not been successfully indicted, although the presence of viable causative viruses in sewage has been repeatedly demonstrated.32 Also, while considerable anxiety has been expressed as to the possible transmission of polio by bathing waters, no satisfactory epidemiological evidence is available to indict such waters.

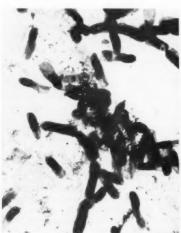
Lensen et al.³³ report that free chlorine residuals as low as 0.1 ppm after 30 minutes' contact effectively inactivate the virus in water. These investigators further suggest a significant viricidal effect of combined chlorine residuals. Significantly, the viricidal capacity of free and combined available chlorine decreased at high pH levels.

Coxsackie Virus. Clark and Kabler³⁴ have demonstrated that the time required for the inactivation of purified suspensions of readily-cultured Coxsackie virus in water by free chlorine depends on the usual factors of temperature, pH and concentration of available chlorine. They report that from 7 to 46 times more free chlorine is required to inactivate the virus than to inactivate a suspension of E. coli cells. Their results are summarized in Table 1.

Gilcreas³⁵ reports that a reduction of coliform organisms by 0.2 ppm or more chlorine "will probably accomplish a parallel destruction of viruses", and that at doses of 0.1 ppm or less, viruses survive to a greater extent than do coliforms.

Observations regarding the adequacy of chlorination with respect to viability of water-borne viruses are inconclusive and conflicting. Obviously, the efficacy of disinfection varies with the character of the water and the resistance of the causative virus. Research is indicated to







Courtesy Division of Water Purification, Chicago, Illinois

● WATER-BORNE streptococci shown at the left are from a 24-hr. lactose culture on a test of chlorinated drinking water. Streptococci of fecal origin frequently cause genito-urinary infections. The middle illustration shows Bacillus cereus, a common organism in soil and water, in various stages of sporu-

lation. A group of *Pseudomonas* organisms (at the right) with typical single flagella. Some bacteria of this genus are of sewage origin, cause several infections in man, and manifest strong resistance to chlorination. Magnification in these electron micrographs are respectively 5000X, 2750X, and 16,000X.

establish the minimum lethal doses of various available chlorine forms necessary under various conditions of contact time, temperature and organic composition.

Conclusions

The record of the reduced incidence of water-borne diseases accompanying the advent of water treatment, including chlorine disinfection, and the adoption of the coliform standard testify to the merits of these procedures. However, continuing research is indicated to establish minimum water treatment practice that will provide a biologically safe water supply and control methods by which this can be demonstrated. The water works profession and industry can not afford the luxury of ignorance even though it might be tempered by past performance.

Pending these accomplishments each treatment facility should regularly and carefully evaluate its needs and objectives, and provide a margin of reasonable safety, especially under unusual circumstances. In some cases, this will involve a substantial increase in the chlorine residual customarily maintained even though lesser residuals might yield water that seemingly conforms with the existing bacteriologic standard. This would appear to be especially applicable where disinfection is the only treatment employed. Pending the availability of more precise data, the maintenance of minimum chlorine residuals recommended at military installations⁵ would appear to represent a reasonable approach, but should not replace actual biological analysis as the true measure of potability.

While there is good cause for concern over the role of water-borne viruses in disease transmission, there is not sufficient conclusive evidence to deserve alarm over either recognized shortcomings of conventional bacteriological tests, or the possible viricidal inadequacy of bactericidal chlorine doses. The evidence is sufficiently impressive, however, to warrant intensive research of these considerations.

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AT Taft Research Center, drum holds tubes of living tissue cultures to permit virus cultivation for study.

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Residential Community Gets Special REFUSE COLLECTION SERVICES

RAYMOND M. URQUHART

Village Administrator Bronxville, New York

THE "commuting carriage trade" residents in the fashionable metropolitan New York village of Bronxville—28 minutes from Times Square—have long been accustomed to a pattern of local refuse collection operations well beyond the financial reach, perhaps, of most of the many thousand communities in this country.

At approximately \$10 per capita, the 2,000 families in suburban Bronxville are offered the following:

- Two pickups each week of burnable refuse.
- One pickup every week of nonburnable trash.
- One collection weekly during the growing season of gardening debris; e.g. grass clippings.
- Twice every month any discarded bulky material is hauled away on request.

This list of services, standing alone, is not particularly impressive but the program is a continuing challenge to the Superintendent of Public Works and his 16-man crew. Normal functions of refuse collection are carried out daily. However, since our mile square community is the setting for many large tree shaded lots, with thousands of luxuriant trees lining the streets and lanes, the extra burden of two months of intensive leaf collection taxes the energies of village crews each year.

Residential Collections

The village has two collection districts which are serviced by village crews working a 44-hour, six-day week. This gives each district two collections of garbage and burnable materials and one pickup of nonburnables. Almost the only sign that refuse collection trucks are passing through the village picking up household trash are neatly stacked bundles of burlap-wrapped refuse piled at intervals along village streets. Four men plus the driver are assigned to each of two village collection vehicles. The men go from house to house, upending trash



DEBRIS resulting from home work, such as grass clippings and brush cuttings, are left at the edge of the pavement by the homeowner and are picked up by two roving crews. It is loaded into a packer-type truck and hauled to a county-operated dump.

cans onto five-foot square pieces of burlap which are tied and then carted off to two or three pickup points along each street. Each piece of burlap is usually serviceable for about 35 pickups, but its use is more limited if the waste is wet. Excessive rainfall similarly will affect the useful life of the burlap squares. Each man starts out with eight or ten pieces of burlap.

This work continues while the two trucks are passing from street to street, the driver stopping to toss the stacked bundles into the open truck body. The trash laden trucks are relieved of their load at an incinerator three miles beyond the village border in neighboring East-chester, a town which includes Bronxville and a second village, Tuckahoe. All three communities use the 33-year old incinerator jointly, and the two villages pay the town for this service.

The highly effective refuse collection program in the village is tarnished somewhat by the need for open body trucks. The dumping height of more modern packer body vehicles thus far has prevented their use in the old incinerator, which has an unusually low ceiling. However, the burlap wrappings for household refuse is a satisfactory deterrent to the nuisances generally associated with garbage collection in open trucks.

As the trucks are loaded and depart for the incinerator, the eight collection workers continue their job, depositing the burlap wrapped bundles at the curb. In this manner no time is lost and trash is cleaned up in half of the village in one day.

Still a third collection is made each week at each residence, at which time non-burnable refuse is collected. For this the men leave their burlap squares behind and use baskets to remove discarded cans and bottles.

Apartment houses in the village are handled in a slightly different manner. Nearly all these buildings have incinerators and only the residue from incineration is hauled away by village crews. Collections are made twice weekly.

The disposal site for this residue is located right in the village. Several years ago an exposed river bed was acquired by the village when the Bronx River along the community's northern boundary was being straightened. This three-acre site is being utilized for a sanitary fill and later will be developed as a park. Sufficient material is available at the site for use as cover.

Gardening Debris

Grass clippings, brush and other gardening material left at the edge of the pavement in front of any home by gardeners, professional handymen or weekend amateurs is picked up each week by two roving crews. The material is scooped up

with pitchforks and rakes and is hauled to a dumping site operated by Westchester County at Croton Point, some 20 miles north of Bronxville. Until this year, much of the garden debris was dumped at a sixacre site acquired by the village for park purposes, the refuse later handled again and hauled off to the county disposal area as time permitted. Since the open village trucks could not pack the debris tightly, many trips were required. This practice was modified early in 1958, when the village hired a private scavenger with a packer body truck to replace village trucks. Now the gardening debris is trucked directly to the permanent disposal site. eliminating a second handling of the

Bulky Items

At one time the village picked up bulky material not easily handled in regular collection operations whenever a request was phoned in to the Department of Public Works, but this practice was recently discontinued. Now the service is offered twice monthly, and it is felt that no villager has been inconvenienced unduly by this reduction in special pickups. In general there are no size or weight limitations placed on this service. Village forces do not pick up tree trunks, though once in a while a villager will cut the trunk of a tree into several long lengths and pile it at the curb along with the usual trimmed branches. On such occasions residents are not easily dissuaded from service-abovecost demands.

Both the non-burnables removed from residences each week and the bulky materials collected twice a month are temporarily dumped at the village's sanitary fill site. A private scavenger is retained by the village to haul these materials in a packer body truck to the county landfill site for ultimate disposal.

In addition to the regular collection schedule, village employees have extra work annually when leaves start to fall from the thousands of trees. Great quantities of leaves filling the gutters of residential streets can be a source of irritation to citizens if they are not removed quickly. For this operation the village uses a Good Roads trailer mounted vacuum leaf collector which sucks the leaves up through a flexible hose and discharges them into a 12 cu. yd hopper. This machine makes it possible to complete a leaf collection throughout the village at least once a week.

A year ago, a committee appointed by the Westchester County Village Officials' Association to look into the critical refuse disposal problem in the county came up with a plea to set up a county-wide garbage disposal district to finance a multimillion dollar incinerator at Croton Point, about 30 miles from New York City.

The committee explored two other disposal methods — dumping refuse at sea and sanitary landfill at Croton Point. Both methods were quickly ruled out when New York City officials expressed strong disapproval of the plan to dump garbage at sea, and county officials reported that even now dirt cover is hauled to the dumping area from other sections of the county.

Unless the whole character of the village is abruptly changed in the years ahead by a gradual break-up of the many palatial estates, there appears to be little liklihood of any modification in the present refuse collection program. Eventually the village will acquire more serviceable equipment, but this can occur only after the town incinerator, which long ago outlived its usefulness, is replaced.

Refuse collection costs in Bronxville will increase moderately year by year, but for at least the next two decades any upward trend in this budget will be influenced largely by charges for disposing of refuse beyond the village borders, and only to a lesser extent by a population growth.



 TRASH is dumped from the containers onto 5-ft, square pieces of burlap which are tied at the corners and taken to one of two or three pickup points in the block.



● LEAVES are a fall problem. Here is the Village leaf loader; it has a vacuum attachment which shreds the leaves as they pass into the truck. Capacity 12 cu. yds.



TOWN ENGINEERING and

JAMES WOOD, Town Engineer, Rotterdam, N. Y.

THE TOWN of Rotterdam, Schenectady County, New York, covers 36.3 square miles and extends about 13 miles along the southerly side of the City of Schenectady and the Mohawk River. By special U. S. Census, the population was 26,600 in 1957.

The Engineer in Rotterdam is a Town Official appointed by the Town Board for two-year periods. The Town Engineer works in conjunction with the Town Board and the Superintendent of Highways on problems relating to town drainage, road and building construction, zoning and related activities. He is allowed considerable leeway in the exercise of independent judgment in planning the details of town engineering projects and is held responsible for good technical results.

Drainage

Drainage has had first priority since 1952 when a flood emergency was declared. This flooding occurred when there was an abnormally high ground water condition following extensive housing subdivision development. The situation was temporarily met at the time by an extensive system of ditches constructed both with heavy equipment and by hand labor of the townspeople themselves.

Since becoming Town Engineer in January, 1955, more than eight miles of storm sewers ranging from 12 to 72-in. have been constructed by the Town Highway Department. This program has been on a pay-as-you-go budget appropriation of \$40,000, increased to \$50,000 annually for materials only.

A 48-in. trunk storm sewer was laid at a ½ percent grade through a large development where 1927 topographic maps indicated a stream had been obliterated with no provision for controlling the ground water level. Various conditions, such as clearing wooded areas and installation of a large water distribution system, where only private sewage disposal systems were in use, plus a wet year, brought about the flooding emergency of 1952 which was most serious in built-up areas behind

the development. The route of the trunk storm sewer was particularly acceptable to the people in the stranded area because it was the key to two drainage areas which previously had been planned separately. The ditches are gradually being eliminated.

Zoning

Zoning has been in the forefront almost as much as drainage since 1955. After many meetings of the



 48-INCH storm sewer constructed through previously filled area eliminated flooding and lowered ground water.

Town Board and other groups, the approved residential, business and industrial zoned areas were marked on an existing 4-ft. x 10-ft. map of the Town. Copies of this map, suitably marked, serve as the drainage map. Town storm sewers are shown in red, State drainage in green and County drainage in broken green lines; another print shows fire district boundaries in red, water district boundaries in green, and light districts in yellow; development plots and subdivision boundaries are indicated on another print, together with key numbers for indexing. Half-size prints of the Zoning Map 2-ft. x 5-ft. are available for miscellaneous use including sale to the public. The zoning map, which shows streets, the State Thruway, schools, parks, churches, public buildings, etc., serves as a land use map. In other words the zoning map is the key map of the Town.

Floodway channel zoning was adapted to and incorporated in the Rotterdam Zoning Ordinance by Amendment on June 13, 1956. Twenty-six floodway channels were subsequently defined for the ordinance and marked on the map by resolution of the Town Board.

A floodway channel is defined in the Zoning Ordinance as follows: "A passage for storm and/or surface waters along a natural water course and/or along an artificial channel constructed under due process of law for passage of storm and/or surface waters."

The following uses are prohibited in floodway channel districts: "The erection, use and/or maintenance of any structures or buildings whether the same be residential or commercial; the obstruction by any means whatsoever, of any stream or stream bed whether natural or artificial; the deposit within said floodway channel districts of earth, ashes, rubbish, tree trunks, stumps, rubble, concrete, masonry, garbage, refuse or other trash."

In the event the water courses running through a floodway channel district "are channeled through underground pipe installed and laid in accordance with standard practice as specified by the Town Engineer so as to carry off without back flooding the usual waters flowing therein, such portion of such floodway channel district so installed with pipe will revert to the zone in which it was classified on the effective date of this amendment.

"Unless otherwise defined or unless otherwise shown on the zoning map of the Town of Rotterdam, as amended from time to time, floodway channel districts shall be 56 feet in width, the center line of which shall be the center line of the stream and/or ditch bed which runs through such floodway channel district. In no event, however, shall the boundary lines of any such district be less in width than the distance between the opposite banks of the bed and/or ravine through which said stream or ditch runs."

Under Chapter 295 of the Laws of 1956, Sect. 263 of the Town Law

FLOOD PLAIN ZONING

for Creating Districts in a Town for Zoning and Planning, the section was changed from "... to secure safety from fire, panic and other danger;" to read"... to secure safety from fire, flood, panic and other danger." Thus, insertion of the word "flood" was held to allow "Floodway Channel Zoning."

Planning Commission

A Planning Commission, whose actions are referred to the Town Board, makes recommendation for changes in Zoning and conducts hearings for new developments. A developer's drainage plan for a

cifications and construction contracts are under the Town Engineer.

Water District 3, originally constructed in 1948, is entirely separate from the other water systems in the town. It has only a part-time Superintendent who is also the operator. The Town Engineer is closely in touch with the operation and maintenance of this district and its extensions. He prepares the annual budgets for approval and adoption by the Town Board whose members are Commissioners of the Water District.

Other engineering work on which the Town Engineer's force has been maintenance and swimming pool construction. Lighting districts and their extensions must have their boundaries described and mapped, construction estimated and individual rates determined from assessed valuations of property. After a public hearing, the Town Board directs the Power Co. to make the installation. Lighting of state and county highways is taken care of by the state and county.

Sidewalks

Sidewalks along state and county highways in the Town must be coordinated with engineering requirements of the State Public Works and County Highway Departments. Beginning in 1955, there has been an annual appropriation of \$10,000 increased to \$11,000 for 1959. About one mile of sidewalk has been constructed each year by a special crew under direction of the Highway Department. The Town must agree to accept liability responsibility and snow removal in order to receive permits for such construction. The above cost has included rough grading and moving terraces back, drain installation, retaining walls, transplanting of hedges, etc. So far we have avoided easements by staying within the highway limits. The sidewalk sites have been chosen according to urgent needs of school children. As soon as emergency conditions are met the Town may decide on having concrete sidewalks built under contract.



 WELL-POINT system was used to dewater backfilled area to permit construction of manhole on new 42-inch storm drain. Depth of hole is indicated by 15-foot rod.

sub-division is referred to the Town Engineer for approval. When approved the latter must estimate the amount of performance bond to cover street drainage, grading and paving to be done by the contractors. After the Town Engineer and Highway Superintendent approve the completed construction, the Town Board acts upon the acceptance of new streets by the Town.

The Town Building Inspector is the enforcement official for Zoning. The Town of Rotterdam accepted the State Building Code also. Thus, a builder may choose between the two codes, in which case the companion plumbing code must be used.

Water District No. 5, planned by Barker & Wheeler, Consulting Engrs., in 1952, is now being greatly expanded under Extension No. 8. It is under a Superintendent who is also Supt. of Sewers. Water District No. 3 has recently had two large extensions and increased facilities, including a new well and pump, Venturi indicator - recorder and telemetering. All planning, specalled in are water main extensions, sidewalks, traffic lights, tennis courts, comfort stations, retaining walls, sanitary landfill, mosquito control, multiple unit steel buildings, bridge replacement, building



 TYPICAL of spring flooding that occurs. Construction of a ditch beginning at left foreground of picture will alleviate conditions pending sewer construction.

COEFFICIENTS

FOR THE SOLUTION

of MANNING'S FORMULA

THEODORE N. KAPOUSTINE, Engineer,

Buck, Seifert and Jost, Consulting Engineers, New York City

THE Manning formula has come into general use for the design of sewers and conduits. Nomographs^{1, 2} have been devised to facilitate the solution of Manning's formula. Tables³ also are published which provide solutions for a wide range of conduit sizes and rates of flow.

Another method for solving Manning's formula which has proven very convenient in the design of circular sewers is a table of coefficients (Table 1), designed for use with the slide rule or calculating machine. This table provides values for the more commonly used sewer sizes and facilitates the solution of two basic equations.

$$V = \frac{Q}{A} \dots \dots (1)$$

$$S = \frac{V^2}{K} \dots (2)$$

or, in another form

$$S = CQ^2$$
 (2A)

where

V = velocity in feet per second

Q = discharge in cubic feet per second

A = area of pipe in square feet

 $C = 0.7878D^{-16/3}$ (D = pipe dimension feet)

 $K = 2.0578D^{4/3}$ (D = pipe diameter in feet)

S = slope in feet per 1000 feet

The coefficients C and K are based on the solution of Manning's formula with n=0.013. For use with any other value of the friction factor "n", the slope "S" is multiplied by

$$\left(\frac{n}{0.013}\right)^2$$

Solution of the Manning formula with the aid of Table 1 is rapid and simple. Chances for error are mini-

TABLE 1—FLOW IN CIRCULAR PIPES

| Size | Area | Coefficient | Coefficien |
|--------|-------------|-------------|------------|
| Inches | Square Feet | | |
| 6 | 0.1963 | 31.76 | 0.8166 |
| 8 | 0.3490 | 6.848 | 1.198 |
| 10 | 0.5455 | 2.083 | 1.614 |
| 12 | 0.7854 | 0.7878 | 2.058 |
| 14 | 1.069 | 0.3462 | 2.527 |
| 15 | 1.227 | 0.2396 | 2.771 |
| 16 | 1,396 | 0.1699 | 3.020 |
| 18 | 1.767 | 0.09063 | 3.533 |
| 20 | 2.182 | 0.05166 | 4.066 |
| 21 | 2.405 | 0.03983 | 4.340 |
| 24 | 3.142 | 0.01954 | 5.185 |
| 27 | 3.976 | 0.01043 | 6.067 |
| 30 | 4,908 | 0.005944 | 6.981 |
| 33 | 5.940 | 0.003575 | 7.928 |
| 36 | 7.069 | 0.002248 | 8.903 |
| 39 | 8.298 | 0.001467 | 9.906 |
| 42 | 9.621 | 0.0009880 | 10.935 |
| 48 | 12.57 | 0.0004847 | 13.07 |
| 54 | 15.90 | 0.0002586 | 15.29 |
| 60 | 19.64 | 0.0001474 | 17.59 |
| 66 | 23.76 | 0.00008868 | 19.98 |
| 72 | 28.27 | 0.00005575 | 22.43 |
| 78 | 33.18 | 0.00003638 | 24.96 |
| 84 | 38.48 | 0.00002450 | 27.55 |
| 90 | 44.18 | 0.00001696 | 30.21 |
| 96 | 50.27 | 0.00001202 | 32.92 |
| 102 | 56.75 | 0.000008702 | 35.96 |

mized because the computations have been so simplified. Two examples will illustrate how easily and quickly a problem is solved using Table 1.

Problem

What slope is required if a $60^{\circ\prime}$ pipe (n = 0.015) is to carry 100 cfs?

Solution:

Substituting the value of C from Table 1 in equation (2A) gives:

$$S_{(n=0.013)} = CQ^2$$

= 0.0001474 x 100²
= 1.47 ft. per 1000 ft.

$$S_{(n=0.015)} = \left(\frac{0.015}{0.013}\right)^2 x 1.47$$
= 1.96 ft. per 1000 ft.
ANS.

Problem

What flow will a 60'' pipe (n = 0.015) carry when laid on a slope of 1.96 feet per 1000 feet?

Solution

$$S_{(\pi=0.013)} = 1.96 \left(\frac{0.013}{0.015}\right)^2$$

= 1.47 ft. per 1000 ft.
Substituting the value of C from

table 1 in equation (2A) gives: PUBLIC WORKS for March, 1959

$$Q^2 = \frac{S}{C} = \frac{1.47}{0.0001474} = 10,000$$
 so that

$$Q = \sqrt{10,000}$$

= 100 cfsANS.

An alternate solution using equation (2) and the coefficient K from Table 1 gives:

$$V^2 = KS_{(n=0.013)}$$

= 17.59 x 1.47 = 25.85

$$V = \sqrt{25.85} = 5.08 \,\text{ft. per sec.}$$

Substituting the area of the pipe from Table 1 in equation (1) gives:

$$Q = AV = 19.64 \times 5.08$$

 $Q = 100 \text{ cfs} \dots \text{ANS}.$

Derivation of Coefficients

Those who may be interested in the derivation of the coefficients of Table 1 may refer to the Manning

$$V = \frac{1.486}{n} R^{2/3} S^{1/2} \dots (3)$$

which can be written

$$V^2 = \left(\frac{1.486}{n}\right)^2 R^{4/3} S \dots (4)$$

For circular conduits flowing full, the hydraulic radius R equals onequarter of the pipe diameter (R = D/4 feet). With a friction factor of n = 0.013, equation (4) above for circular pipes becomes:

$$V^2 = \left(\frac{1.486}{0.013}\right)^2 \left(\frac{1}{4}\right)^{4/3} D^{4/3} S \quad (5)$$

or simplified and converting the value of S to feet per 1000 feet

$$V^2 = 2.0578 D^{4/3} S \dots (6)$$

Thus,
$$S = \frac{V^2}{K}$$
 where

$$K = 2.0578 D^{4/3}$$

The slope also may be expressed in terms of the discharge Q. From equation (1), V = Q/A, by squaring both sides,

$$V^2 = \frac{Q^2}{A^2} \dots (8)$$

For circular conduits $A = \frac{\pi D^2}{4}$ so

$$V^2 = \frac{Q^2}{A^2} = \frac{16Q^2}{\pi^2 D^4} \dots (9)$$

Substituting this value of V2 in equation (7) it follows that

$$S = \frac{V^2}{K} = \frac{\frac{16Q^2}{\pi^2 D^4}}{2.058 D^{4/3}}$$
$$= \frac{16}{2.058\pi^2 D^{16/3}} \times Q^2 ... (10)$$

which simplifies to

$$S = CQ^2 \dots (11)$$

where $C = 0.787803D^{-16/3}$

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SEWAGE PUMPING STATIONS BUILT BELOW RIVER LEVEL

LARGE percentage of the cost of the multi-million-dollar sanitary sewer improvement program now under way in western Pennsylvania goes for pumping and sewage plant installations constructed below the water level of the Allegheny River-a river badly in need of pollution relief as it now carries the wastes of the cities along it. Two of the cities described in this article illustrate this fact: Oil City and Warren, Pennsylvania. In these, several million dollars are being spent currently on sanitary sewer improvements.

The cities, jointly having some 60,000 population, are split by the Allegheny River some 90 to 100 miles northeast of Pittsburgh. Both are concerned with major sewerage improvements. In addition to treatment plants adjacent to the river, Oil City and Warren are building lift or pumping stations on the river banks below water level.



 CHECKING factory-made flexible compression-type joints on a shipment of vitrified clay pipe delivered at the site of the Warren, Pennsylvania, job.

Looking at Oil City first, the General Authority of Oil City last year floated a \$1,700,000 bond issue for sanitary improvements originating from state recommendations. As early as November, 1957, residents began paying for the work through charges added to water bills.

The bond issue provided the funds for eleven contracts to get the improvements under way. One of the most interesting phases is the construction of the pumping station on the river bank. The excavations for this pumping station are below river level and dewatering equipment had to be installed as excavating progressed. This main pumping station rises from 12 feet below the river bed, and only modern dewatering techniques made the project feasible.

This lift station will house three pumps, each a 1400-gpm unit, and provision will be made for a possible fourth unit should the city require it. Pumping will be from a 33-foot well. This well will collect sewage from 12, 18, and 27-inch interceptors on the north side of Oil City.

Placing of the pumping station below river level makes it possible to force the sewage through a special 18-inch main laid under the river bed. This main will run 1300 feet uphill to a manhole, where gravity flow will take it to the new sewage plant now under construction.

An additional pumping station will gather sewage at a low spot in the southeast section of the city. Two 300-gpm pumps will lift the sewage 37 ft. for gravity flow to the plant. The entire program, of course, includes a number of diversion manholes, and several miles of vitrified clay pipe for service connection.

Service connections have been in progress for some time. Louis Kraft of Oil City has a \$30,000 contract that was under way last fall. The 8-inch service lines utilize factory made flexible, compression type joints which not only make for speed and ease of installation, even in very cold weather, but also provide a tight line, materially reducing or

preventing infiltration.

R. B. Fleming, of Morris Knowles, Inc., is resident engineer on the Oil City job. B. B. Weber is city engineer of Oil City. Major contractors include Ben Construction, Pitt Construction Co., and W. R. Davies, all of Pittsburgh; L. O. Boquin, Oil City; Frank Kukwin & Sons, E. McKeesport; and Millcreek Electric Co. and Church and Murdock, both of Erie.

At Warren, the Christopher Construction Co. of Columbus, Ohio, has the job of building a sewage treatment plant below river water level-a \$600,000 contract. Here dewatering equipment again comes into prominent use, keeping seepage below the excavation level.

Two pumping stations are being built by Keystone Construction Co., Meadville, at a cost of \$172,000. The biggest of the two will have a sump 30 feet in depth, with approximately 16 feet of it below river water level. Two pumps will force the sewage about 400 feet under the river through a 10-inch main to the dis-

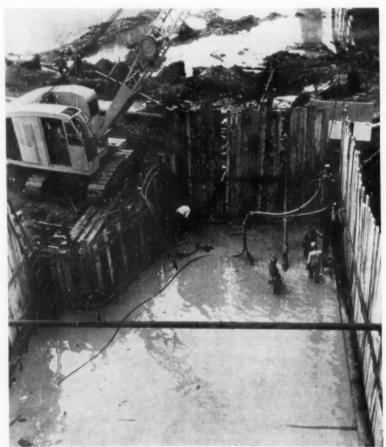
posal plant.

Chester Engineers, Pittsburgh, drew up the general plans for Warren, while John Bensink, of Hill & Hill, North East, Pa., is resident engineer and inspector. This arrangement grew out of the fact that Hill & Hill are consultants for Warren. which has no city engineer. The installation of the piping on this project is also accelerated through the use of vitrified clay sewer pipe with factory-made compression joints for the mains and service connections.

It is interesting to note that Warren is paying for its sanitary improvement program through sewer rentals based on 105 percent of water bills; an average home pays about \$34 per year.



BUILDING a sewage treatment plant below river level usually involves many difficulties in construction. Liberal use of well-points permitted construction.



PUMPING station also involved dewatering problems. Foundations were 12 ft. below the river bed. Station will house three pumps, with provision for a fourth.

OHIO'S ROADSIDE RESTS

Increase Travel Pleasure

WILBUR J. GARMHAUSEN,

Chief Landscape Architect,
Ohio Department of Highways

OHIO'S Roadside Rests as we know them today are a modern innovation, but the principle behind them is as old as the history of man. In fact, countless centuries ago, there were Roadside Rests of a sort, even before there were roads.

During the early stages of civilization, in Arabia, North Africa and Asia, caravan trails were routed in such a way as to connect series of oases. There at these waterholes the traveler, exhausted after a trip over the desert sands, might find surcease from the sun under the shade of green palm trees. There he might quench his thirst and rest in preparation for another journey over the waste.

From records left by the Greek historian, Herodotus, it is known that a great road was built in Egypt over which material was transported to be used in the construction of the pyramid of Cheops. Herodotus also records that along this road temples were erected for the convenience of travelers desiring to rest and worship.

When Caesar ruled his vast empire, the traveler was furnished with a list called an "Itineratium" which designated the location of stops along the roads.

Centuries later, in the "stage coach days," taverns and inns provided for the physical comfort of the traveling public, later railway stations fulfilled this function for those who traveled by rail.

Like the watering places on the ancient caravan routes of the East, Ohio's Roadside Rests are oases for tired tourists today. They are outstanding among the nation's highway rest areas in that they provide complete facilities for the convenience, relaxation and enjoyment of the public. Built solely in the public's interest, Ohio's 273 Roadside Rests are open without charge of any kind to those who choose to use them. These are an outgrowth of our first Roadside Park which was built as an experiment in 1935. Ranging from one acre to two.



Ohio's Roadside Parks accommodate about fifteen automobiles and are situated mostly in rural sections, along highways all over the state. No two parks are identical, but all have much in common. All land upon which the state built these earlier parks was obtained without cost. Today these Roadside Parks are not large enough to provide adequately for the traffic on our primary limited access roads. A check of traffic re-

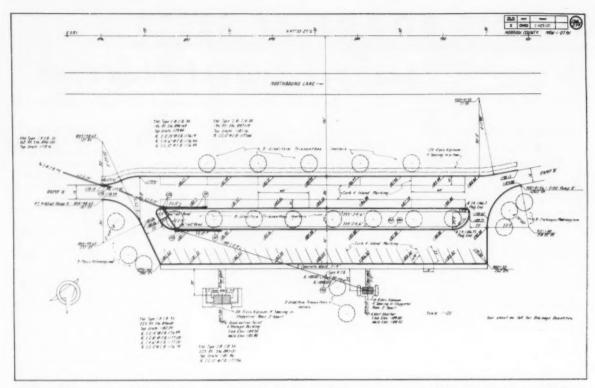
veals that an average of seven percent of the traffic avails itself of the park facilities. Today our park areas must be doubled in size to accommodate traffic and a survey reveals that by 1965, we again will have to increase the size of the parks.

Ohio is sharply aware of the need for modern designed and efficient Roadside Rests on the Interstate Highway System. We have enacted legislation which allows the highway department to purchase sites for Roadside Rest purposes. Location, purchase and building of parks is now under general highway construction. We are now in a position to select the sites where we want to build Roadside Rests. The following Directive on Roadside Rests was sent to all Deputy Directors, Department Heads and Division Engineers by Ohio's then Acting Highway Director, George J. Thormver.

A) General: Roadside rest areas will be included normally in the design of Interstate Projects and on other major roads where complete limitation of access is secured for a length of highway exceeding 25 miles. The purpose for providing these areas is to promote highway safety, provide necessary services



 WATER supply must be adequate and pure. This shows a typical well shelter with pump protected against surface contamination. A shelter house is in background.



TYPICAL layout for a Roadside Rest area, showing planting, parking arrangements, facilities and spacing from highway.

for rest and relaxation and furnish a place where a dangerously tired driver may refresh himself. It is not intended these areas be selected to provide picnic grounds for the local residents.

B) Location of Roadside Rest Areas: Roadside Rest Areas shall be normally located at intervals of approximately 25 miles on each side of the highway. These areas shall not be placed opposite one another if location at staggered spots is feasible. Staggered areas should preferably be located so that the one on the right of directional traffic would be reached before the one on the left. Areas should be located away from traffic interchanges and at least three miles from a municipality.

C) Selection: The selection of the Roadside Rest Areas shall be made promptly after the roadway line and grade has been established. The Landscape Architect shall examine the terrain adjacent to the highway and shall select feasible locations for the establishment of these areas, giving consideration to: 1) Existing wooded areas for shade, with pleasant surroundings; 2) areas at elevation above profile of road; 3) visibility to highway traffic for ingress and egress; 4) ramp grades designed to assist vehicles in de-

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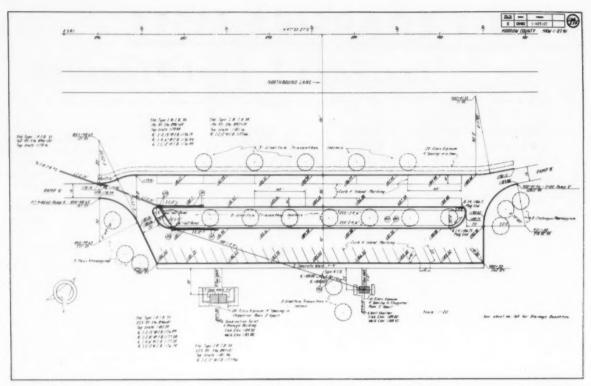
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 - 2. Parking spaces
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B. Rest area facilities for convenience and comfort

1. Water supply

2. Table and benches

a. Pentachlorophenol (water repellent)

b. Brass screws

3. Sanitary facilities

a. Stone - brick - wood -

(1) Pressure treated wood cadium plated or aluminum nails

b. Light and ventilation c. Vault-Flush type toilet

d. Heated building

4. Shelter buildings

5. Fires-fireplaces a. Charcoal grills

6. Garbage and trash disposal

7. Telephone Power lines

9. Buffer areas

C. Grass areas

1. Type of seed D. Planted areas

1. Reforestation III. Combination of Rest Areas with other Facilities

A. Police and maintenance struc-

1. Where these may be feasible

B. Other combinations

1. Gasoline Service Stations

2. Eating Plazas

a. Difficulties to be encountered

IV. Rest Areas to be Constructed on General Contract

1. Purchase Right of Way with Roadway Purchase 2. Change orders

V. Some Past Experiences

A. Types of rest areas proven satisfactory

1. Reason for satisfaction

B. Types of rest areas which have not been satisfactory

1. Because of defects in design

2. Because of developments after highway construction

VI. Future Trends in Rest Area Design and Maintenance

A. Effects of increased traffic

1. Results of heavy use of rest

B. Effects of change in adjacent land use

1. Logging and lumbering

2. Intensive agriculture

3. Change from agriculture to residential and industrial land use as affecting rest areas

VII. Conclusions and Recommendations

A. Need for balanced design

B. Special problems on Interstate Highways

1. Consultants

As we continue to build Roadside Rests and as the public use them. we no doubt will need to make some further changes in design and construction to keep them up to date. As of now they incorporate the best thinking in modern design. We hope that other states may benefit from our experiences. The recently approved American Association of State Highway Officials policy on Safety Rest Areas for the National System of Interstate and Defense Highways is much welcomed and will be of great value.

Results of Questionnaire

So that we might know what other states were incorporating in the Roadside Rest design a questionnaire was sent out to all states. A compilation of the answers received from the 48 states is as follows:

Do you have Roadside Rests on the Interstate Highway System-24 (Yes)

Do you intend to-12 (Yes)

Do you have Roadside Rests on roads other than the Interstate Highway-47 (Yes)

Do you use shelter houses-13 (Yes in all parks) 6 (In some)

Do you think you should provide

shelter houses for inclement weather -8 (Yes)

Do you provide drinking water-11 (In all parks) 23 (In some)

Hand pump-11-Water under pressure-10: Both hand pump and pressure-13

What is your method of refuse disposal-1 bury; 35 collect; 1 bury and incinerate; 3 collect and bury; 7 incinerate and collect

Do you have a travel information board-5 (All parks) 2 (In some)

Do you have a travel information station, lodge or booth-2 (In park) 8 (Not in park)

Do you have electric lights in area-2 (All parks) 10 (In some)

Do you provide toilet facilities-15 (Yes): 16 Vault type: 5 Flush type; 6 Both. Is flush type designed for all year use-5 (Yes); Is building heated-1 (Yes)

Do you provide telephone service -6 (In some); Vending machines-

Does the Highway Patrol police the area-31 (Yes)

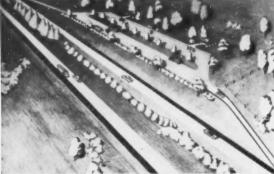
How is park maintained-1 Caretaker; 38 Crew; 9 Both

The maintenance of the park is under whose supervision-10 Landscape Architect; 33 Maintenance Superintendent; 2 Other; 3 Both

You and I know the statistics released by the National Safety Council. The greatest killer on our highways is speed-next is fatigue.

There is only one way to combat fatigue-that is rest or change of position and occupation. Think back to one of your stops at a Roadside Rest-you leave it relaxed and more alert-the result is safer driving, less accidents and to quote one of the summer's catchy slogans you "arrive alive."

Ohio's Roadside Rests are truly oases for weary travelers, and they make our travels safer and more pleasant.



 SPACIOUS parking strips and attractive landscaping, as shown in this sketch, help make roadside rest areas popular.



 YEAR-ROUND use of roadside rests is encouraged by keeping them plowed and open. Drivers get tired in the winter, too.



• EQUALIZING reservoir, upper left, is adjacent to filter plant and provides gravity feed, storage and presedimentation.

WATER PROJECT DESIGNED FOR SEVEN-FOLD EXPANSION

J. D. McGILLIS, and GENE A. CLAUSSEN, Civil Engineers, Ken R. White, Consulting Engineer, Denver, Colorado

HE phenomenal population growth of Denver's suburb, Aurora, Colorado, from 11,421 in 1950 to an estimated 35,000 at the present time, has necessitated development of an interesting domestic water project. This growth was brought about by an influx of citizens employed by Federal installations in and near Aurora such as Fitzsimmons Army Hospital, Lowry Air Force Base, Buckley Air Force Base and the Rocky Mountain Arsenal. In addition to this, there has been a movement of some people from Denver into Aurora. These developments have resulted in the city taking immediate and long range steps to provide the city with an adequate domestic water supply. Previously the city purchased all of its water from the Denver Water Board. The supply has been delivered through a number of conduits extending across boundary lines along streets connecting the two cities.

The geographical growth of Aurora has been in an opposite direction from Denver and has extended in three directions. About 1952, the City of Denver, due to the heavy demand placed on its water system, established its "blue line," beyond which it would not provide water. This excluded all areas annexed after the boundary line was established and restricted Aurora from furnishing water to any customers outside of the boundary. Aurora was consequently forced to look elsewhere for a supply of water sufficiently large to serve its anticipated future population.

Possible Solutions

There were a number of steps that could be taken. One was the development of wells along Cherry Creek, approximately five miles from the City; another was obtaining water from the South Platte River, approximately twenty miles away; and still another was the acquisition of water from the mountainous area to the west of Denver. Water available from the last source would require transmountain diversion through tunnels and long aqueducts, a rather expensive undertaking. However, after investigating the availability of water from the Cherry Creek aquifer, the city decided that the transmountain water was the only alternative in order to meet adequately the demands anticipated in the extended future.

A program was initiated immediately to develop wells on Cherry Creek as an initial phase in the overall plan. This project was completed at a cost of \$1.4 million in 1955 and consisted of four 1,000gpm wells, the necessary piping and a 4.5-mg storage reservoir which would supply the city by gravity. In addition, proceedings were brought to secure water rights on the western slope of the Continental Divide and to acquire any available water that could be obtained from the South Platte River. The City purchased about 10 cfs of irrigation water from the owners of a ditch supplied from the South Platte River. Litigation is progressing on the allocation of approximately 62 cfs. In order to show intent to use the water beneficially, city officials decided to construct a treatment plant and a conduit to Aurora. These facilities would handle not only the initial 10 cfs from the irrigation ditch but would be designed to permit easy expansion when the western slope water would be allocated.

The existing demand is approximately 3½ mgd. That anticipated by 1962 is between 5 and 6 mgd and by 1970, approximately 8 mgd. The City estimates that it will need 40 mgd within 25 years.

The new works were designed by the firm of Ken R. White, consulting engineer, and consist chiefly of a concrete diversion structure at the ditch, 1800 ft. of 24-in. steel pipe providing gravity flow to a concrete presedimentation basin; a 10-cfs capacity pumping station; 14,000 ft. of 24-in. steel pressure pipe; an earthen equalizing reservoir; a water treatment plant; and 18 miles of 40-in. steel pipe providing gravity flow to Aurora.

Pumping Station

The pump house consists mainly of two electrically operated 150-hp vertical turbine pumps; two electrically operated 125-hp vertical turbine pumps; and one vertical turbine pump powered by a 150-hp liquid propane gas engine for standby service. The pressure line is protected by an 8-in. Pelton surge suppressor. The four electric pumps lift the 10 cfs 363.5 feet in elevation to the equalizing reservoir located adjacent to the filter plant.

The instrumentation and controls in the pump house consist mostly of a level indicator and a recorder which receives its signal from a float operated transmitter at the equalizing reservoir via leased telephone lines. These instruments also

control the program switch which starts and stops individual pumps based on various levels of the reservoir.

Instruments are provided which indicate, record and totalize flow entering the presedimentation basin. The signal to these instruments is received via a buried conduit from a float operated transmitter located at the Parshall flume at the diversion structure.

The equalizing reservoir is a twocell earthen structure lined with a catalytically blown asphalt membrane. Its purpose is threefold: To provide a constant equally controlled gravity source of raw water to the treatment plant; to provide for 8 hours storage of raw water at the design flow in the event of pump failure; and to provide some additional presedimentation capacity to reduce the load on the clarifier.

Plant Description

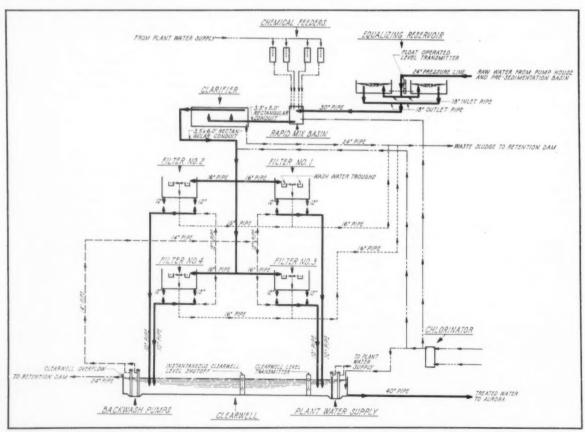
The water treatment plant is located at a point near the front range of the mountains at an elevation sufficient to provide gravity flow from the plant to the Aurora. One of the controlling factors in the selection of the site was to make possession.

sible, at a later date, receiving gravity flow from the South Platte River through a tunnel bored through the front range mountains from the South Platte Canyon.

The raw water enters the filter plant from the equalizing reservoir by gravity through a 30-in. steel pipeline. The flow is regulated manually just prior to the rapid mix basin by a 16-in. rate of flow controller. Future flow is provided for by wall pipe and blind flanges through the building and rapid mix basin walls. Thus, it will not be difficult to install a pipe and rate controller parallel to the original arrangement.

The flow proceeds from the rapid mix basin to the mixing and reaction zone of the clarifier through a rectangular concrete conduit which will accommodate the ultimate flow of 40 mgd. The clarifier is concrete, rectangular, open and of the upflow type. The conduit is plugged at the far wall of the clarifier with concrete knockout panels and can be extended as future clarifiers are added. Five are contemplated, utilizing common walls.

Sludge is moved by rectangular scrapers to a helicoid collector, and



• FLOW AND piping diagram of filter plant, showing general arrangement of equalizing reservoir, clarifier and filters.

a portion of the sludge is then removed by the automatic operation of a Viggers blowoff valve. The wasted sludge passes through a 24-in. concrete waste line to an earthen retention reservoir. Thence it is discharged slowly through irrigation gates to the drain course below.

The clarified water enters a common channel leading to a rectangular conduit and thence to the filters. The conduit acts as a manifold for the filters on each side. The end of the conduit consists of a concrete knockout panel at the far wall of the filter building and is designed to accommodate the ultimate 40 mgd by the addition of twenty more filters.

The filters are of the rapid sand type with Wheeler bottoms. For control of filtration, signals are transmitted hydraulically from operating tables to all valves and rate controllers. Backwashing is accomplished by pumping treated water from the clearwell. Backwash pipelines are sized for the ultimate design flow.

All of the steel pipe used on this project was fabricated by Thompson Pipe and Steel Co. in Denver and is coal tar enameled, wrapped with a coal tar impregnated felt on the outside, joined by Dresser couplings every 120 feet and welded at 40-ft. intermediate joints. Further corrosion protection is provided by the use of induced current cathodic protection. The crossing of Cherry Creek required that the pipe be attached to piling because of quicksand conditions. The creek crossing lies within the maximum pool area of the Cherry Creek Dam.

A meter for treated water, with a 24-in. venturi insert nozzle as the primary element, is located below the treatment plant on the 40-in. steel treated water pipe line. The signal is transmitted electrically to an instrument mounted on the main panel located on the operating floor of the treatment plant.

The terminal reservoir level is also indicated on the instrument panel on the operation floor with signal transmission by leased telephone lines. The plant operator can therefore plan in advance what is to be expected of the plant with regard to treated water required.

Chlorine solution can be injected into the rapid mix basin (pre-clarifier), rectangular conduit to filters (pre-filter), and the 40-in. steel line immediately leaving the clearwell (post chlorination).

The plant will contain a modern laboratory, a superintendent's office, locker and shower facilities for the

operators and a motor control center all on the same floor of the control building. The top floor contains the chlorine room and chemical storage area. The chemical feeder hoppers extend through the floor for ease in filling, A 2000-lb, electric hoist is provided on the top floor to lift chemicals and chlorine gas cylinders directly from the truck unloading platform between the building and the clarifier. All floors within the plant, except the lower floor will be hardened with nonmetallic Masterplate, made by Master Builders Co., for ease of cleaning and durability.

Outside access has been provided to the end of the pipe gallery by a double door and excavated road for future filter and clearwell extensions. The end wall of the clearwell contains three rectangular openings with steel plate and neoprene gasket covers. When expansion becomes necessary, the concrete block can be removed and the arch structure extended along the excavation. The steel plates in the clearwell and the door at the end of the pipe gallery can be removed and relocated at the end of the extension. Horizontal reinforcing steel will project from the completed original structure, greased, and covered with a low strength concrete curb for appearance. When the expansion begins, the curb will be broken out, the steel cleaned, and new reinforcing bars welded on to provide an adequate tie to the existing structure. Clarifier structures can also be added on the opposite end of the filter plant.

The operation of the plant is automatic in the sense that once the rate of flow is selected, and proper controls set to treat this rate, no further adjustments will be required unless the incoming raw water changes appreciably in physical and chemical characteristics. The

plant is started and stopped automatically through level controls in the clearwell.

Cost Data

The installation of the 40-in. steel treated water pipe was by Wade Lahar Construction Company of Arvada, Colorado, in November, 1957, for a total construction cost of \$360,058. The City of Aurora purchased the pipe, valves and appurtenances for \$1,547,756.

The pipe line will deliver approximately 18.3 mgd to the terminal reservoir and therefore the expansion of the water treatment plant will not require an additional pipe line until the demand exceeds this figure. Sufficient right-of-way has been purchased to accommodate a parallel line to reach the ultimate

40 mgd.

The contract for the construction of the pump house, 24-in. steel pipe pressure conduit and water treatment plant was awarded to F. H. Linneman Co. of Lakewood, Colorado, in April, 1958, for a total bid cost of \$412,499. The equipment furnished by the City of Aurora for installation by the contractor amounted to \$279,804. This brings the total construction cost of the Platte Project to about \$2.6 million.

The cost of the treatment plant itself, including equalizing reservoir, all equipment, retention dam, yard piping etc., will amount to only \$404,655. Since the plant can be overloaded to 8 mgd with little reduced efficiency and due to the fact that some of this cost must be allotted to oversizing a portion of the structure for future flow, the comparative economy of this type design is evident. The plant should be in operation in the spring of 1959. The City of Aurora, as a result of this project, is assured of an adequate water supply for many years in the future.

MANUFACTURERS OF MAJOR EQUIPMENT

Aurora Pump Div., New York Air Brake Co. Slurry recirculation pump, 400

gpm, 3 hp.

Builders-Providence, Inc., Div. of B-I-F Industries

Filter operating tables, No. FTPV-M Venturi insert nozzle, Model NZIF Rate-of-flow controllers, Model RCB-T

Omega Machine Co., Div. of B-I-F Industries Chemical feeders, Model 2 Pelton Div., Baldwin-Lima-Hamilton Corp.

Surge suppressor

Walker Process Equipment Inc. Rapid mixer, Type FV Slow mixers, Type MV Rectangular sludge collectors Helicoid sludge collectors Viggers valve

Wallace and Tiernan Inc. Chlorinator, Series A-626

Waukesha Motor Co. Gas engine

Worthington Corp. Vertical turbine pumps

New Jersey Turnpike

Utilizes Electronics

for Traffic Surveillance

LEO G. SANDS

LECTRONICS is being used by the New Jersey Turnpike Authority for traffic surveillance because hit and miss manual methods won't work. Radar, instead of the human eye, counts and determines the speed of vehicles traversing the busy toll highway. At the New Jersey Turnpike Authority head-quarters building in New Brunswick, direct reading meters display the speed and volume of traffic as well as accumulated total number of hours of traffic volume in six different categories.

Tedious hours of compilation and computation of figures obtained by human beings on a hit and miss basis, and subject to significant inaccuracies, are avoided. Standard manual methods, which may yield satisfactory information in some instances, will not do for the New Jersey Turnpike. Electronics does a better, more accurate job, according to Edmund R. Ricker, traffic engineer for the turnpike.

Three radar sensing units, one suspended over each of the three southbound lanes of the turnpike near Linden, New Jersey, count the number of vehicles traveling in their respective lanes and also report the speed of these vehicles.

When manual means for taking a traffic count are employed, the findings are subject to human error. To duplicate the 24-hour, year-round vigil of the radar sensing units by manual means would require considerable, even prohibitive expense, and the results would not be as accurate or as meaningful.

Some traffic engineers feel that road tubes are unsatisfactory and that pressure or magnetic type actuators are preferable. However, since it is expensive to install actuators within the road bed, radar sensing units are preferred because of their portability. On the turnpike, they have already been used at two locations. Originally, the radar detectors were installed over three northbound lanes. In June, 1958, they were

moved to their present location to monitor southbound traffic.

The radar sensing units report both traffic count and vehicle speeds. They operate on the doppler principle. A microwave radio beam is aimed at the road which reflects it back to the sensing unit. When a vehicle passes under the sensing unit, the vehicle reflects the radio signal back to the detector which now makes the round trip in a shorter time because the distance the radio signal must travel is now smaller. Also, the movement of the vehicle varies this distance and it is the rate at which

maintenance costs are taken into consideration. Over greater distances or where a larger number of detectors are used, radio or a microwave system, which could also be used for other purposes, might prove to be more economical.



In the headquarters building three Electro-Matic Traffic Monitors have been installed, one for each lane being monitored, plus a graphic recorder which makes a permanent record of vehicle count and average vehicle speed for each lane.





COMPONENTS of the sensing system. At left above is the 21-pound radar unit which is suspended over each lane to be monitored. Sensitivity of each unit may be adjusted to local requirements by setting knob of the waterproof control unit shown at right. A typical mounting on overpass bridge is illustrated at top of the page.

this distance varies that causes the frequency of the received signal to differ slightly from the frequency of the original signal transmitted from the radar device.

This information is transmitted over leased telephone circuits in the form of audio tones to the turnpike headquarters building. A separate line is used for each of the three radar sensing units. A radio link could be used as the transmission medium, but in this case leased lines are less expensive when investment in radio equipment and

Each Traffic Monitor is provided with a Radar Speed and Impulse Translator which receives the impulses from the radar sensing unit monitoring its respective lane. A meter on the front panel indicates vehicle speed directly in miles per hour. An electric voltage representing vehicle speed is fed to a Speed Averaging Computer which determines the average speed of vehicles traveling in that particular lane. This average speed is arrived at by combining information on the speed of a predetermined and adjustable

number of vehicles with the speed of the "last car" of the group. The average vehicle speed is computed electronically on a root-meansquare (RMS) basis. The square of the speed of the "last car" is averaged with the sum of the previously squared vehicle speed readings. The average speed reading which can be read directly in mph on a meter, is the square root of the squared average. Another meter indicates the speed of the "last car". The average speed level is permanently recorded by a graphic recorder for future reference while the present value can be read directly on a meter.

The Radar Speed and Impulse Translator also feeds an electrical impulse to the Volume Computer each time a vehicle passes under the associated radar sensing unit. Traffic volume may be read directly from a meter which is calibrated in percentage of a preset and adjustable level of traffic flow which represents 100 percent. If set to 1800 cars per lane per hour, for instance, the meter will indicate 50 percent when the volume rate is 900 cars per hour.

Five dials are provided for setting

up volume in terms of percentage of capacity in six groups. One may be adjusted for 1200-1400 cars per hour per lane, the next to 1400-1600, another to 1600-1800 and so

This information from the Volume Computer is fed to the Volume Classification Unit which contains six direct-reading elapsed-time meters. They indicate the total number of hours that traffic volume has been sustained in each of the six categories.

Instead of having to use tedious manual methods to determine how many hours per year traffic volume reached full capacity or any other segment of full capacity or even overload conditions, this information is obtained by merely reading the numbers on the elapsed-time meters. Thus, traffic volume information, up to date as of the moment, may be obtained without any kind of manual calculations or guesses. It is continuously available and without errors since it misses no vehicles at all.

Some very interesting information about driver habits has been compiled at the turnpike headquarters. The average indicated speed of the driver is 57 mph, just below the 60 mile speed limit. The meters show that very few cars exceed the speed limit and that the center and far left lanes are more heavily traveled than the far right



• TRAFFIC monitors, one for each lane being monitored, are installed in Headquarters building. They register speed of individual cars and compute the average.

lane, which in most states is the lane in which one should drive at all times except to pass.

When traffic volume is very low, the meters indicate that the right lane carries the most traffic. But as volume builds up the traffic in the two other lanes increases more rapidly. During the heaviest peaks, the far left lane carries the most traffic. Also, in bad weather, drivers seem to prefer the far left lane, which may then carry more traffic than the other two lanes combined.

Drivers Judge Safe Speed

In bad weather, as in snow storms, the speed limit on the turnpike is cut down to 35 mph. When to restore the speed limit to 60 mph is determined by the Traffic Monitor. When the weather lets up, the meters indicate an increase in average speed. It has been found that the average driver is a better judge of what the speed limit should be than an arbitrary statute. It is the speed which is assumed by the majority of drivers that apparently should be the measuring stick for determining maximum safe speed.

Mr. Ricker said that the Traffic Monitor was ordered from the Automatic Signal Division of Eastern Industries, Inc., early in 1957 and was placed in service in September of the same year. As stated earlier, the three radar sensing units were installed over the three northbound lanes near Linden, New Jersey initially. In June they were moved to the southbound lanes. Since the radar sensors can be easily removed and reinstalled, they can be set up anywhere on the turnpike to measure traffic speed and volume.

Traffic volume information is used by traffic engineers for determining when and if a specific road should be widened or otherwise improved to facilitate the flow of traffic. Generally, a road is designed to accommodate the anticipated traffic volume that would exist during the 30th busiest hour of a year. If designed to handle absolute maximum traffic flow, the cost of the road could be prohibitive. Thus, up to 29 hours of overload may exist by design while the traffic during the remaining 8730 hours per year is not expected to reach full design capacity.

Ordinarily, arrival at these figures requires ponderous paper work and mathematics. With the Traffic Monitor, this information is available instantly and from the faces of meters calibrated in hours. When

the meter which shows more than 29 accumulated hours when traffic volume was in excess of 100 percent, it is an indication that the road is inadequate under presently accepted standards.

In addition to expressways, freeways, parkways, turnpikes and other limited-access, high-speed roads, the Traffic Monitor can be useful for studying traffic patterns of city streets. One suggested application is for automatic setting of speed limits through small communities located on highways. Speed limits through hamlets and villages are set low so that through traffic will not interfere with the light local traffic and also to protect children and other pedestrians wishing to cross the highway. While such low speed limits make sense during

school and business hours, very few drivers observe such limits during the night when there are virtually no persons or cars in the streets. A Traffic Monitor could be used to post automatically acceptable speed limits, based on the speed level set by the majority of drivers using the road.

While the Traffic Monitor system is used at the New Jersey Turnpike to monitor traffic on all three southbound lanes on a continuous basis, similar equipment can be used to monitor traffic at several different locations. The Electro-Matic Traffic Volume Computer is provided with controls for accommodating up to four radar sensing units. A switch is provided which permits sampling of any one of four lanes, which may be at various locations, or two,

three or four lanes simultaneously. Indications, under such circumstances, will be for average traffic volume per lane.

Installation is simple. The Monitor equipment itself requires 117 volts AC at about 500 watts for each lane to be monitored continuously. The radar sensing units also require 117 volts AC, but power consumption is only 30 watts each. A single telephone pair, a two-wire line or a single-channel, one-way radio link is required for joining each radar sensing unit with the monitoring equipment. When three detectors are installed adjacent to each other, three telephone lines, a three-pair cable or a radio link capable of handling three voice circuits (one-way) may be used.



PINPOINTING HIGHWAY SCHEDULES with a Graph System

JAMES F. BASKFIELD,

Methods Analyst
Minnesota Highway Department,
St. Paul, Minnesota

THERE ONCE was a day when Minnesota Highway Department engineers could pinpoint the exact status of all scheduled road work without having to refer to written progress records. As the old saying goes, however, those days are gone forever. Minnesota's rapid development in highway construction has stripped single projects of their individuality and stressed their importance as parts of a great network.

To cope with this major change in requirements, our department recently adopted a system of production control featuring techniques similar to those employed in private industry. It is built around a series of wall boards which tell at a glance the exact planning status of 270 individual trunk and interstate highway projects in the State's current \$103 million road program, and their relative positions to the other projects on the planning boards.

Basis of the system is a planning sequence of 31 steps. Each step, or phase, has been assigned a percentage value weighted according to the amount of work involved. Although the percentage scale of the three divisions concerned—Plans, Bridges and Right-of-Way—differ in actual form, they are all based on the same idea.

Job Progress Charting

Our Remington Rand Sched-U-Graph system, on which the progress of projects costing \$150,000 or more is charted, consists of a number of wall-mounted aluminum panels 43 inches wide by 47 inches high. The face of each board has 100 horizontal pockets, each of which features a 3/8-inch transparent visible index strip carrying a percentage scale.

One pocket is assigned to each project. At its left is inserted a colored card containing all details pertinent to the project. A blue card, whose index portion is always visible in the plastic-covered pocket edge, signifies an interstate project. Salmon-colored cards are used in conjunction with trunk highways. Index portions of the cards carry

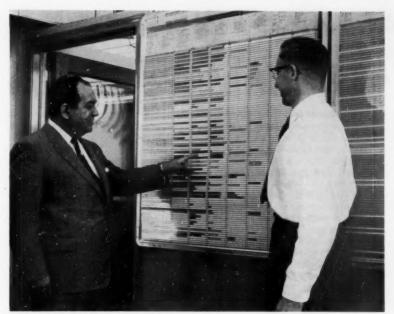
district and S.P. numbers, bridge number, the type of work involved, and its location.

At the top of each Sched-U-Graph board is a typewritten legend explaining all percentage values, and interpreting the colors used to signal progress, special situations, etc. Values are indicated by a movable Graph-A-Matic signal, which is positioned along the percentage of progress scale, certain sections of which show how work is progressing in the three divisions involved.

In Minnesota, made up of 87 counties, trunk highways are broken down into construction sections having numbers within each county. For highway planning and building purposes the state is further divided into nine construction districts. The construction section number is the key to finding a specific job on the boards within the nine construction districts.

No lengthy indoctrination is required for reading the boards. The number of the job is always visible at the left margin of the column. Jobs are filed first by districts, then by control section numbers.

When a desired number is located, reference to the top of the board



 CONSTRUCTION progress is easily checked. At left is F. D. Marzitelli, Deputy Commissioner of Highways; at right is Harry Lyon, Jr., Assistant to Reports Engineer

indicates the column to be read. By following it down to the proper pocket, the percentage of progress is determined immediately. Reference to the legend at the top of the board is then made to see exactly what work has been completed, and how much remains to be done.

The boards are maintained on the basis of bi-monthly reports which

must include certain prescribed information. Each of the three Divisions is he'd responsible for its own reports. When they become available on the 1st and 15th of each month, the data is first transferred to a permanent record, and from this the proper percentage adjustments are made.

For maximum utility the boards

have been located in the Plans, Bridge, Right-of-Way and administration offices. The unit in each Division constitutes the master visual record of the work it has in progress.

Progress of the Plans, Right-of-Way and the Bridge Divisions may be seen on the boards in Plans, Bridge, and Administration. The Right-of-Way boards, however, show only the progress being made by that division itself, and by the Plans Division.

Our Sched-U-Graph system, which was installed in May, 1958, has proven to be both flexible and efficient. It has simplified the business of reallocating manpower from one job to another; to determine more accurately contract letting dates; to spot bottlenecks before they cause serious delay, or even before they occur; and to make other time and money-saving adjustments.

One advantage comes as a byproduct. Because it required tightening up on work progress reporting requirements, reporting has become far more accurate and much more dependable.

We no longer work in the dark insofar as highway planning is concerned. We always have a comprehensive, overall picture available right in front of our eyes, and are in a much better position effectively and economically to administer Minnesota's huge highway program.

MOTOR GRADER HAS MANY USES

JOHN F. DONAHUE,

Superintendent, Bureau of Streets and Director of Sanitation, Worcester, Massachusetts

THE BUREAU of Streets of the City of Worcester, Massachusetts, purchased a Galion grader, Model 160, early in 1958 from the E. J. Bleiler Equipment Company, Needham, Mass. This machine was used during the remainder of the past winter in plowing snow and in removing ice from our streets. It has also been used on various types of construction work, such as spreading blacktop on our resurfacing work; grading old surfaces to establish new grades; grading subbases on new construction work; and grading gravel borrow in construction.

PUBLIC WORKS for March, 1959

This grader has performed all work superbly and is the most powerful machine of this type that we own. It is exceedingly effective on snow and ice, which is difficult work; and it also performs very well when mud becomes an adverse factor in carrying on our work efficiently.

The maintenance of this grader has been negligible since we purchased it in spite of the constant use it has had, and the performance has been outstanding.

I might state that we keep daily records of all maintenance costs on all our equipment and are able at any time to set forth the cost of gas, oil and general repairs to any piece of equipment that we own and operate.



on a

EARTHMOVING

on an INTERSTATE Project

CONSTRUCTION of the 2,335,000-yard earthmoving phase of a joint venture 6.7-mile interstate road project between Boca and Floristan, Calif., was a major job. The joint project of Isbell Construction Co., Gordon H. Ball Construction Co., Gordon H. Ball, and Grantie Construction Co. is a \$7,325,011 contract to construct a portion of U. S. 40 to interstate standards.

Eighteen Caterpillar D8 Tractors, a D9 and a Euclid C-6 were used on the steep and rugged granite mountain job. In clearing the right-of-way for the new four-lane highway, the crawlers at times were winched into position; benches were cut in the mountainside and then the crawlers were winched back to other jobs. The crawler-dozed benches served as drilling locations while the drill-and-shoot teams inched along the section.

Two Ingersoll - Rand 6½ - inch "Drillmaster", and five smaller Crawl-IR drills served as primary tools in the solid granite portions of the excavation. Initial holes were opened with the Crawl-IR drills, and the larger "Drillmaster" units moved into open up the holes to blasting size. Two 900, four 600, two 105 and one 315-cu. ft. portable compressors supplied the drills through aluminum tubing.

Isbell shooting crews used fertilizer-grade ammonia nitrate in the 6½-inch holes. Sensitized with one gallon of diesel fuel to an 80-pound bag, the ammonia nitrate was detonated with a primer and primacord. The crews used a 12 x 12-foot pattern in the granite, since this produced manageable sized material for shovels.

One 5½-yard Bucyrus-Erie shovel powered by a Cat D397 electric set, a six-yard Bucyrus-Erie, and four ½½-yard Northwest shovels loaded the shot granite into 29 Euclid dump trucks. Hauls averaged about 500 yards. Maximum cut on the new segment of road is 225 feet at Iceland Point, near the east end of Isbell's job. The highest fill is 190 feet.

After the trucks dumped the excavated material (granite and sand loam) in the fill areas, it was spread by one or more of the D8s, and brought to 90 percent Proctor with sheepsfoot rollers pulled by D8s. Three Cat No. 12 motor graders maintained the haul routes and assisted in spreading fill material. During the hours of darkness, the men worked by light supplied by eight Kohler 5-KW portable light plants.

Concrete paving and bridge work on the project is being constructed by the Gordon H. Ball Construction Co. The 11 bridges along the route will take 1,957.5 tons of structural steel, 805 tons of reinforcing steel and 8,710 cubic yards of Class A concrete. The Boca bridges are 869

and 860 feet long and each is 28 feet wide. The Hinton road undercrossings will be 82 feet long, each 39 feet wide. The Iceland sidehill viaduct will be two 39-ft. sections. 144 feet along; the Truckee river bridges at Floristan will be a pair of welded structural steel girder units 343 feet long. The westbound bridge will be 28 feet wide and the eastbound bridge will be 38 feet wide. The second set of bridges across the Truckee river will be 384 feet long, and each bridge will be 28 feet wide. The Truckee river bridge crossing to the town of Floristan will be a single reinforced concrete box girder structure 182 feet long and 28 feet wide.

The completed roadway will be two 24-foot concrete strips, divided by a variable median of six to 26 feet. Specifications call for 12 inches of imported sub-base material (minus 21/2-inch granite), topped with four inches of cement-treated subgrade material, and eight inches of concrete roadway. The 10-foot outside shoulders and the 5-foot inside shoulders will also have 12 inches of minus 21/2-inch granite, topped with 1½-inch untreated base, with six inches of cement-treated base and a three-inch plant mix surface. Slope of outside ditches will be 6:1 and to the median will be 10:1.

K. C. Jones is the resident engineer on the job for the California Highway Department.



MORE ROCK than dirt was found on sections of this job.
 Four-lane road, with wide curves, required much excavation.



SPREADING fill posed a tough job on section of US 40.
 After spreading sheepsfoot rollers were used for compaction.

employees, we will use the same criterion in making public as we do private purchases. If we fail in this

responsibility, is it any worse than

if we fail to design a structure prop-

erly or if we fail properly to admin-

ister our other duties? Why is the

matter of purchasing equipment so

different that the public employee

must, by law in many instances, be

required to ask for bids on his

equipment purchases? Why can he

not be held responsible for his total,

rather than only a part of his job?

edge that the taking of bids may be

a closed transaction; just as closed

as if we went out and purchased

outright the particular piece of equipment we desire. In other

words, when we really want a par-

ticular piece of equipment, we usu-

ally study the specification of all

similar makes and then write our

specification so that only what we

believe to be the best will qualify.

It is like the special legislation we

occasionally get. The bill applies

only to a county of certain size or

population with so many cities of a

certain population. It is closed. The

legislature cannot say, "This bill ap-

plies only to Marion County". We

cannot say that our specification ap-

plies only to Earthworm tractors.

tom? When cannot we be honest and

Isn't it a ridiculous rule or cus-

I think that it is common knowl-



where they may? Why can't we stand up and be counted for our actions?

Motor Graders

Or are we counted anyhow? We, in Marion County, honestly and sincerely believe that one particular brand of motor grader is the best by far. Since we operate 25 of them regularly on our 1648 miles of road, and some of them are about 20 years old, we feel that our bias is justified. We have had other brands over the last 20 years and they have been replaced for cause. Why can't we, on the basis of our experience, buy only that brand that we know (in our own minds) is best? Why do we have to consider all makes when we purchase new motor graders? The competition knows we are biased. They know we will probably not buy their make-yet they must go through the ritual of offering a proposal. We must go through the ritual of considering their proposal. We must inform all bidders that we reserve the right to reject any or all bids and make our purchase according to our judgment of the best proposal and not according to the lowest price.

We are counted. Everyone knows our bias, many think we are unduly influenced (to put it mildly). Shall we use our public trust and funds to divide our business among those who want it or shall we take the

beating and give it to the dealer that deserves it by making a machine that gives years of service; that has a machine that does not change models like a car, each year or so; that currently stock repairs for even the oldest models or have parts available at reasonable cost; that actually give good service and not just talk it?

Still, on the other hand, perhaps this criticism because we hold to one make (some call it persecution) is good for our soul. Since we buy only one brand of motor grader, it means that we have to be on our toes to counteract the adverse feeling from unhappy competitors. It behooves us to be careful that we purchase the equipment of our choice at the lowest possible price. It forces us to keep abreast in the improvements on our preferred kind of equipment. Yes, it makes it imperative that we listen to the sales talk and read the specifications of all other like equipment in order that we not go to sleep and fail to recognize the normal fluctuation of quality in equipment. For equipment manufacturers can rest on their laurels, as well as the engineers, and not keep abreast with modern improvements. We truly want to buy the best, and when we are convinced that something else is better, we will change brands and stay with that brand until we are convinced that something is better.

say the special Earthworm tractor is the best and that we won't consider any other inferior make? Why can't

we be honest and let the chips fall

Just how good or how economical is it to shop around and buy a few of all makes: to admit we don't have a mind of our own? Regardless of other circumstances, it is expedient to keep a certain stock of repair parts on hand. A judicial stock of most common parts in the shop will pay off in reduction of shutdown time. If we have more than one make of equipment, we more than double our stock. Various makes of equipment require various special tools. The more brands the more special tools. Various makes of equipment have different settings and tolerances. This adds to the mechanic's responsibility. While we do not make it a practice of changing operators on our equipment, when it is necessary we do so with confidence because they are all trained to operate in the same brand. Certainly there are other costs in owning equipment than the original cost. Each user will have to analyze his own setup and do as he thinks best.

Up to this point I have discussed only our problems in purchasing motor graders, because in this field we feel we know what we want. In the matter of purchasing crawler tractors, while we have not purchased a tractor since the war, we feel that with this experience we have the best brand made and I am sure that when we do purchase a tractor, we will not purchase on the basis of the lowest price.

Other Allied Road Equipment

Now, in the field of other allied road equipment, we are not as positive in our opinions as to the relative merits of the various makes. Here we fall back on comprehensive bidding in its truest form. Still we insert at the bottom of all proposal forms the statement that we reserve the right to accept or reject any or all bids and make our award according to our best judgment.

If we are in the market for a piece of equipment which represents a new phase in road building to us, we will usually accept invitations to visit the various makes in operation in the territory. We watch it work, we talk to the operator, and we usually talk to the engineer in charge. We question the value of more than a careful inspection of the machine that has been in use for some time, for we find that most people are prone not to knock their own equipment. If the owner has a good record of the

operating expenses, we like to check it, then together with the visual inspection of its operation and condition, we feel that we, perhaps, have a true picture of the equipment. We consider the dealer's plant. Is he qualified to take care of the machine; is his reputation good on making adjustments; can he supply repairs in a reasonable time; is he established in the business or will he be out of business when we need him most?

When we have settled in our own minds the makes we are willing to consider in the purchase, then we study the specifications of these various makes. We decide the minimum size motor and other minimums that are critical on that particular type of equipment. We then list these various specifications where they can be compared and work out our call for bids using the minimums of all the makes to be considered which we feel are safe. When all this is completed, we add the reservation on the bottom of the proposal that we reserve the right to accept or reject any or all bids and make our award according to our best judgment.

Wherever possible, we try to make our purchases of equipment from local merchants. We feel that they have an investment within our county and that if everything else is equal, they should be given consideration. On the other hand, our responsibility is to the tax-payer as a whole and not to the small percent of taxpayers who may be situated to make a profit on our transaction.

In other words, we do not feel justified in penalizing the large percent of taxpayers and pay a premium just to trade with a home merchant. Yet we do give a slight preference to a local merchant.

Some Examples

A year ago we took bids on an 11 wheel, self propelled, pneumatic roller. Since these small rollers were new on the market, we found it difficult to work up a specification for bids. In this case, we decided on a few basic requirements we would like to have in a roller. We wanted an 11 wheel, self propelled roller, with smooth tires, a sprinkler system, and capable of producing in excess of 225 pounds per inch of pressure per inch of tire tread. We then asked each bidder to supply us with his bid, the name and model of the engine, its rated horsepower and whether it had a starter. We asked for information regarding the transmission, speeds forward and reverse, steering, type of wheels and whether the wheels were on stiff or oscillating axles. Finally, we left a few lines wherein the dealer could add any extra selling points for his machine.

This proposal was sent out to approximately ten dealers and six returned the proposal with a bid. We checked the various specifications of each roller offered, and, in this case, purchased from the lowest bid submitted.

Last spring we purchased a pneumatic truck loader and, in this case, we determined the bucket pay load we desired. After comparing the various specifications and prices, we purchased a loader considerably over the lowest priced.

We are now awaiting delivery of two 2-ton trucks which were purchased on bids with definite specifications. Since local dealers are able to supply this size of truck, the bidding was restricted to dealers within the county. The award was made by accepting two separate bids. There was little difference between two popular makes of trucks and the Commissioners decided to purchase one of each, since repair parts for both are currently stocked within the city and available at a county discount.

Yes, our public purchasing of equipment for Marion County is on a variable schedule. We accept the low bid whenever we are convinced that the low bid is on the best piece of equipment; when our comparison of the critical specification shows the low bid is not the result of cheapening the equipment.

We are willing to pay a slight premium to secure the services of a company that is well established and has a good service and repair department (even though we do our own repair work). We want a good repair department to stand back of the equipment as we expect experts to train our operators, and to serve us during the guarantee period, and we want repair parts available because we know the best equipment will need repairs.

Whenever we are convinced that the field is full of good models of the equipment we desire to purchase, we send our proposals, with minimum specifications, to every dealer we can contact that is equipped to give us service.

But, in general, however the bid is taken, we will always reserve the right to make the award on the basis of our best judgment.

POWER FOR WATER TREATMENT PLANTS

P. E. CARDILLO, Public Works Department, Worthington Corporation, Harrison, New Jersey

N THIS age of atomic power and guided missiles our civil defense units have been making preparations for survival in the event of sudden attack. It is apparent that much thought should be given to providing a continuous water supply should this happen.

In most major disasters, electric power is usually disrupted and in some cases this disruption may last for days. Fortunately, in disasters caused by the elements of nature, it is usually possible within a few hours, or at least within a few days, to repair the damage. In the event of an atomic attack this might not be possible because of area contamination and reduced manpower. Therefore, a water supply must be made independent of any power source that can be demolished or even curtailed.

It is intended in this article to stress the use of an alternate method of providing power in those pumping plants and having such plants located at relatively safe distances from industrial targets, which depend entirely upon electric power supplied from an outside source. Aside from electric power for driving pumping equipment, power can be furnished by diesel engines, gasoline engines, internal combustion gas turbines, and steam turbines. The following discussion is based on past experiences and discussions with various personnel in the water works field.

A first consideration should be a determination by the responsible engineers of the minimum quantity of water needed daily in an extended emergency. With this information, properly sized equipment can be selected. It is assumed that personnel

is properly trained in the operation and maintenance of the installation.

Auxiliary Power

Auxiliary power generator sets can be provided for self-contained electrification in a water works plant. The size and cost would depend upon the starting characteristics of the motors. Normally, however, the higher initial cost of providing the proper auxiliary generator set for complete electric power is not warranted for emergency service. Generators to provide the necessary electric power for lighting and pumping station auxiliaries for housekeeping requirements can be purchased at little cost. Therefore, our discussion will deal only with direct connected prime movers.

Diesel Engines

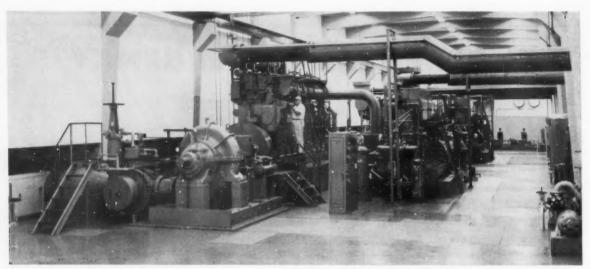
The diesel engine, though slightly higher in initial cost, has some advantages over the gasoline engine. Since the fuel is not as potentially

hazardous as gasoline, lower fire insurance rates result. This may compensate for the higher initial cost within a short period of time. In addition, a diesel engine is not limited to one type of fuel; it is possible to use fuels ranging from JP-4 jet fuel to a number of furnace oils. This fact increases the possibility of an available fuel should a major disaster occur. Engines can be purchased for dual fuel operation where natural gas is available. Diesel engine fuels do not deteriorate when stored for long periods as does gasoline, thus making it possible to start up and operate without diffi-

The fuel consumption in gallons per hour for a diesel engine is considerably less than for a comparable gasoline engine. This is because there is more energy available in diesel fuel per gallon, and because the diesel design has greater thermal efficiency. In an emergency, simple and instantaneous starting is desired.



DUAL-DRIVEN pumps, with 350-hp electric motor drive and 415-hp gasoline engine standbys at Evanston, III. Each pump has capacity of 10 mgd at 151 ft. TDH.



PUMPING installation at Miami, Fla., water works consists of Worthington diesel engine directly connected to pump.

In a diesel engine this is accomplished at present by compressed air, batteries or hydraulic starting.

Gasoline Engines

Gasoline engines are available in sizes up to approximately 500 hp. They represent the most economical power, from the standpoint of initial cost, of the alternates mentioned. However, in considering power from gasoline engines for emergency use, an emergency can not be predicted; it is possible that fuel will have to be kept in storage for long periods. To prevent deterioration with age, it is necessary that proper supply programming be set up and maintained.

Another prime concern is the availability of the fuel. Shortage of gasoline was experienced in World War II. Should another major emergency arise, gasoline use again may have to be seriously curtailed.

Gas Turbines

The internal combustion gas turbine has many desirable features for use as emergency power. Among these are its compactness and adaptability to operate on more than one fuel. This engine can be designed to operate on any one of the known refined fuels, or natural gas, presently used for internal combustion engines. Also available are portable gas turbines which may be desirable in an extended emergency. The efficiency is lower than that realized with other types of prime mover.

It is believed that at the present time the higher initial cost and lower efficiency preclude the use of gas turbines for emergency power in water works plants. As the demand grows for this type of power and new and less costly manufacturing methods are developed, internal combustion gas turbines may be better fitted as prime movers for emergency power.

Steam Turbines

Steam turbines have a place in water works installations, especially for full scale water supply. For emergency operation only, they represent a large initial equipment and building cost to provide and house the boilers, condensers, turbines and all the other equipment needed to obtain the power for delivering water.

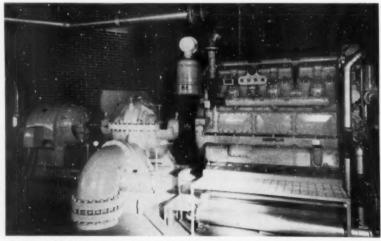
Also a plant representing such an outlay for equipment and money cannot stand idle and unattended. It must be maintained and kept in readiness should the occasion for its use arise. This type of power will

therefore usually be too costly for use only in time of emergency.

Conclusion

It is obvious that all water works installations should have a source of power which can be relied upon in an emergency. The type of power will depend upon availability of fuel, location of the pumping plant, and other local conditions which may be encountered. Although economy may be a minor factor in an emergency, it should be considered in the initial planning to obtain the maximum output for the least cost.

Regardless of the emergency power used, water works engineers should plan all water works installations on the basis of delivering needed water when disasters, with accompanying electric power failures occur.



 DUAL-DRIVEN pump at the McDaniel Lake plant of Springfield, Mo., waterworks is provided with diesel engine standby insurance against failure of electric power.

LANDFILL Ends Refuse Disposal Problems

FRED E. GIESER

Commissioner,
Public Buildings and Grounds,
Highland Park, Illinois

THE LANDFILL method of garbage disposal was initiated in Highland Park, Ill., in 1952, a year after the city council approved an ordinance creating a city garbage department. Both the ordinance and the landfill system were introduced by the author, whose election to the city council in 1951 preceded an appointment as Commissioner of Public Buildings and Grounds.

The landfill system was recommended after intensive study and personal investigation of methods employed by other municipalities in the Chicago area.

The site acquired for the land fill was already in use privately for dumping purposes. The smoke fumes and the scores of rats drawn to the area had aroused justified complaints from neighboring residents. Once in city hands, the dump underwent a complete overhauling—motorized equipment dug trenches, filled them with waste, flattened the area and spread fresh earth over the surface.

More than 13,000 cubic yards of garbage and other refuse are disposed of each month. The cost of disposal averages 8 cents per cubic yard of garbage and 15 cents per cubic yard (not compacted) of refuse. Trenches for disposal, excavated by a 1/2-yard dragline, average 15 feet in depth. After building up a layer of compacted refuse approximately 7 feet deep, a 6-inch layer of earth is applied as a topping. Then another 7-foot layer of compacted refuse is added and likewise covered by an earth topping. Each day's waste is thus buried under fresh earth in the landfill.

Use Reclaimed Land

Besides eliminating a public eyesore and health hazard, the sanitary fill method of waste and garbage disposal has reclaimed otherwise worthless land for valuable use. The city's animal shelter, an Armos steel building, is situated on the filled area and future plans call for the construction of a heliport on land reclaimed by this method.

In addition to the animal shelter, three other Armco buildings are in use at the landfill site. These buildings are: a 220 by 40-foot storage garage for refuse disposal trucks; a 60 by 28-foot garage and office; and a 24 by 16-foot utility building.

Utility Building

The utility building is a veteran of a 1½-hour fire fed by 300 gallons of gasoline. The insurance company considered the building a complete loss and made settlement accordingly. The building was repaired by the Village—at a cost less than one-

third its original price—and returned to use.

The landfill site in Highland Park is large enough to serve five neighboring communities — Deerfield, Glencoe, Highwood, Lake Forest and Libertyville. All the communities use Highland Park's facilities on a cost basis. Another important source of revenue is provided by rental fees from garbage collectors whose trucks are accommodated in the steel garages located at the landfill



● CRAWLER tractors compact waste material in the trench. A dragline excavates trenches to a depth of about 15 ft. Two 7-ft. thick layers of refuse are built up.



FOUR STEEL buildings are used at landfill site. Left to right are the animal shelter, the office and maintenance garage, utility building and large truck garage.

HIGH FILTER LOADING SOLVES

N EXTREMELY rapid increase A in the population of Corpus Christi, Texas, from 57,000 in 1940 to a presently estimated figure of 166,000, has created the need for a corresponding increase in sewage treatment facilities. One of the solutions of this problem was a higher loading on the Broadway plant which lies in the downtown area and cannot be expanded beyond its original area of eight acres. The Broadway plant capacity has been increased from 11 to 17 mgd without adding acreage and by utilizing existing clarifiers, filters and sludge treatment facilities. The long range plan to keep pace with city growth includes a new plant in the suburbs on a site that will permit additions to meet future demands. This new plant is now in the design stage.

The city fronts on a shallow land-locked bay with a small opening connecting it to the Gulf of Mexico which at this point has but little rise and fall of tide. Consequently, there is not much ebb and flow to change the water in the bay and escape of untreated sewage could constitute a health hazard and threaten the excellent boating and bathing facilities.

The original Broadway treatment plant was built in 1936, designed initially to handle 3 mgd and increased to 4 mgd before completion. Five years later, it was carrying a heavy overload, and extensive additions were undertaken to raise the capacity to 11 mgd. Further need for treatment facilities resulted in construction in 1942 of an activated sludge plant near the outskirts of the city. This installation had a capacity of 0.3 mgd, which was later expanded to 7 mgd.

Modifications

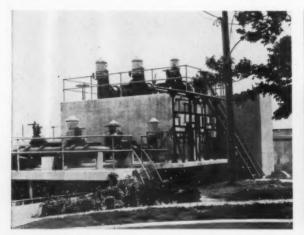
The plan to increase the capacity of the Broadway plant by use of a higher loading was worked out by Drahn Jones, Director of Public Works: S. L. Allison, General Superintendent of the Sewer Department; and the engineering firm of Sigler, Clark and Winston. The general contractors were Burnett Construction Co. The improvements were completed in February, 1957. The plant has three primary clarifiers, five digesters, two intermediate clarifiers, two roughing filters, two final clarifiers, and intermediate pump station, final stage pumps and four standard rate filters, a sludge filtering and drying plant and sludge drying beds nearby, retained for emergency use.

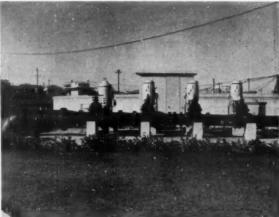
The original main pump house with bar screen equipment and a detritor was doubled in its capacity by the installation of three Fairbanks-Morse vertical centrifugal sewage pumps of 3000 to 6000 gpm capacity each and the relocation at higher level of the two original horizontal F-M centrifugal units also of 3000 gpm

capacity each. This increased the raw sewage pump capacity above 21 mgd. The new pumps deliver their rated 3000 gpm at a 30-ft. head. When storm water raises the level in the well and the head is reduced, pump capacity practically doubles.

It was necessary to replace 20,000 yards of 1½ to 3-in. limestone in the standard trickling filters with a harder stone 3 to 5 ins. in size and to install continuous underdrains on new flooring. This reduced the stone depth to 5 feet and the volume to about 15,000 yards. New center columns were also provided.

One Fairbanks-Morse 12-in. propeller pump driven by a 30-hp F-M motor was added to the group of three intermediate step-up pumps to increase the capacity at this point. A new pump station was built with six propeller pumps installed at two levels. Three of these are relief, taking the excess clarified sewage which cannot be handled by the hydraulically limited roughing filters. All of the pumps in the system are automatically controlled by float operated switches. The entire arrangement permits bypassing the roughing filters to the standard filters and recirculation through them. These filters are operated at standard rates at present with recirculation increased during night-time flows. They will be operated at increased loadings to high rate standards as needed. The arrangement is





HIGHER TRICKLING filter loadings permitted increase in plant capacity from 11 mgd to 17 mgd. At left are three recirculation pumps on lower level and three emergency diversion pumps on upper level. Intermediate clarifier lift station is at right.



FOUR pumps, two of 4,000 gpm capacity and two of 6,000 gpm, pick up the final effluent from the plant and deliver it through two outfall lines to the ship canal.

flexible and sloughing caused by temperature changes is small.

The roughing filters with no recirculation provide a 56 percent BOD reduction at a loading of 5,000 pounds of BOD per acre foot. Some recirculation is provided at night. With the improvements, the standard filters handled a loading of 451 pounds of BOD per acre foot with an average reduction of 42.6 percent in 1957.

Flow is by gravity through the primary clarifiers, roughing filters and intermediate clarifiers. From this point, it is pumped to the modified standard filters. It is finally picked up by four effluent pumps and delivered to the ship canal via outfall lines, one of which is 42 inches in diameter and 4000 ft. long and the other 36 inches in diameter and 7000 ft. long, both at a minus elevation. Two of the propellertype effluent pumps are 12-in. units of 4000 gpm capacity driven by 20hp motors and two are rated 6000 gpm driven by 30-hp motors.

Sludge Handling

Heaters have been provided for the digesters where F-M 200-gpm bladeless pumps are used for recirculation of the sludge. Through the medium of heat exchangers, a higher temperature is maintained in the digesters and the capacity is increased accordingly. Heaters are sized for thermophilic digestion at 105°F. This doubles the capacity of the digesters operating at normal temperature at the cost of a little more heating gas.

One 70-ft. digester receiving intermediate clarifier sludge has been operated at thermophilic temperatures with elimination of objectionable odors.

Supernatant liquor from all digesters is diverted to a Process Engineers thickener where it is pressurized with 0.5 cu, ft. of air per minute at 80 psi, retained for 30 seconds, and released to a tank where the solids rise to the surface and are skimmed off. Optimum solids concentration for this operation is 2 percent. The thickened sludge is removed by bladeless pumps to the digesters and the separated liquor goes to the intermediate clarifiers. This procedure is an innovation in treatment practice. It permits continuous mixing in the digesters.

Treated sludge from the digesters is pumped to a 6 by 8-ft. Eimco Rotobelt vacuum filter. The filter cake is dehydrated in a Standard Steel rotary dryer, ground and screened after which it is bagged and sold as fertilizer. The design capacity was 8 bags per hour, but operation now produces 12 bags per hour with a sludge moisture content of 2 percent. Installation of the dehydrating equipment at both existing plants eliminates the need of drying beds which were responsible for odors and fly breeding. The other outlying plant is equipped with a Komline-Sanderson vacuum filter and a 24 bag-per-hour dryer to dehydrate the sludge.

It is believed that because of intensive industrialization of the area and the limited water supply, industry may find a use for the effluent in connection with power generation or industrial processing.

The total cost of treatment at the Broadway plant is \$35.00 per million gallons. The average power cost for 1957 was \$4.53. This is an increase in cost, but it reflects two conditions. One of these is increased utilization of pumps in connection with higher loading. The other is the unusual amount of rain in 1957 and heavier volume loading with consequent increase in recirculation.

While ultimate expansion of the system will occur at the new suburban plant, it is planned to increase the capacity of the Broadway plant further by high-rating the standard filters. However, this will not entail major modification such as was made in 1956.



● TO PROVIDE better operating control facilities, a new laboratory was included in the expansion and improvement plan for the Broadway plant in the downtown area.



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Michigan Motor Vehicle **Fund Distribution**

Net receipts of the Motor Vehicle Highway Fund of the State of Michigan for the third quarter of the calendar year 1958 amounted to \$38,294,675, a decrease of \$894,974 from the \$39,189,649 collected in the third quarter of 1957. Gross collections for the third quarter of 1958 amounted to \$39,730,412, from which was deducted the Secretary of State's collection costs amounting to \$1,435,737.

All state gasoline, weight and diesel fuel taxes and a small amount of miscellaneous fees collected under the above acts are deposited in the Motor Vehicle Highway Fund. After deductions for non-highway uses and collection costs, the rest of the money is divided as follows: 47 percent to the State Highway Department for expenditure on state trunkline highways in both rural and urban areas; 35 percent to the counties for expenditure on county roads; and 18 percent to the incorporated cities and villages for expenditure on their roads and streets.

Under this distribution formula, the State Highway Department will receive \$17,998,497 as its share of the third quarter of 1958 Motor Vehicle Highway Fund collections. The share of the counties is \$13,-403.136 and that of the incorporated cities and villages is \$6,893,041.

Signing for Greater **Driving Safety on Illinois Tollway**

Nearly 4,000 dark green and white direction signs are being constructed by Federal Sign and Signal Corporation for the Illinois Toll Highway Commission which recently awarded a \$733,226 contract for the construction and installation of all traffic signs on the new turnpike. The total sign area under construction exceeds 100,000 square feet and the project involves 200,000 pounds of aluminum for the signs, and 260,000 pounds of steel for the support structures.

Signs on the new turnpike will be larger than on most highways and they can be seen from a greater distance both during the day and at night. The longest sign is 26 feet in length, and the tallest is 14 feet high. Approximately 25,000 letters and numerals will be included in the signs, and 40,000 feet of reflectorized border will be used. About 15,500 delineators, small silver prismatic "cat's eyes," will mark the shoulders of the road along its en-

tire length.



NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Morse Named General Chairman of 1959 Public Works Congress

Chicago, Ill.—APWA President Wm. B. Hurst recently announced the appointment of Roy Morse, City Engineer of Seattle, Wash., as General Chairman of the 1959 Public Works Congress and Equipment Show. The show and technical sesions will be held in Seattle's civic auditorium September 20-23, 1959. The Olympic Hotel has been designated as the headquarters hotel.

Mr. Morse will be assisted by members of his staff including P. N. Royal, Housing; E. J. Allen, Inspection Trips; E. H. Linstrom, Entertainment; J. R. Robertson, Reception; E. E. Lewarch, Transportation; D. A. Andersen, Auditorium arrangements; and H. E. McMorris and Mrs. McMorris, Ladies' Program. Also serving on the committee are James Strauss, Staff Member, Associated General Contractors of America, Mountain States Chapter, Exhibits; D. J. Evans, Asst. Manager, AGC, Mountain States Chapter, Finance; and E. J. Dale, Portland Cement Association, Publicity and Public Relations.

Va.-D.C.-Md. Chapter Issues "Chapter News"

Alexandria, Va.—The first issue of the Va.-D.C.-Md. "Chapter News" was sent to chapter members in January. Planned for quarterly issue, the "Chapter News" featured a complete description of a forthcoming Spring Meeting scheduled for April 4 at Alexandria. Editor-

in-Chief of the first issue was W. L. Rothgeb, Deputy Director of Public Works for Alexandria, Va., and Chapter President.

Central California Chapter Formed

Fresno, Calif.—Over 80 members and guests were present at the organization meeting of the Central California Chapter held in Fresno, Jan. 9, 1959. The chapter was formed with the active assistance of the Northern California, Southern California and San Diego-Imperial County Chapters. Temporary officers were elected pending formal approval of the Chapter By-Laws by the Board of Directors at its Mid-Year Meeting in Chicago, Feb. 6. M. J. Carozza, Fresno City Di-

rector of Public Works was elected President; Chester A. James, Kern County Public Works Director, First Vice - President; George Imrie, Reedly City Public Works Director, second Vice-President; and John E. Fitzgerald, Fresno, right of way supervisor for the Pacific Telephone and Telegraph Company, secretary-treasurer. National Vice-President Jean Vincenz, and Regional Director John Morin, were present for the ceremonies.

New APWA Sustaining Member

Chicago, Ill. — Austin - Western Works, Construction Equipment Division, Baldwin - Lima - Hamilton Corp., Aurora, Ill., has joined the growing family of APWA sustaining members.



PICTURED at first meeting of the Central California Chapter are Jean Vincenz, George Imrie, M. J. Carozza, J. E. Fitzgerald, C. A. James and John Morin.

OFFICERS: Wm. D. Hurst, Winnipeg. Manitoba, Canada, President; Jean L. Vincenz, San Diego, Calif., Vice President. REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.: (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. Immediate Past President, Sol Ellenson, Newport News, Va. Robert D. Bugher, Executive Director.

Anderson, Hall, Nixon Accept Committee Appointments

Chicago, Ill.—Robert G. Anderson, Construction Engineer, Department of Public Works, Tacoma, Washington, has been selected to represent the APWA on the American Society for Testing Materials Committee D-4, "Road and Paving Materials." P. B. Hall, Director of Public Works, Alexandria, Va., recently accepted an appointment to serve as APWA's representative on the American Standards Association's Committee A-37, "Road Ma-

terials," and R. A. Nixon, Chief of Construction, Atlanta, Ga., was named to the Joint Cooperative Committee of the APWA-Associated General Contractors.

Utah Chapter Meets With County Officials

Salt Lake City, Utah—The Utah Chapter participated in the 36th annual convention of the Utah State Association of County Officials, Jan. 21-23 and held a joint session with the Surveyor's Department. A breakfast meeting on Friday, Jan.

23, chaired by Carl E. Painter, Immediate Past-President of the Utah Chapter was followed by a talk by Howard Bussard, Automotive Safety Foundation, Washington, D. C., and a film entitled "Grants at Little Valley" which features the Southern Pacific Railroad Great Sait Lake Fill Project. Paul Gilgen, Weber County Surveyor, was program chairman, B. E. Mellenthin, Chapter President, chaired the business meeting which followed.

Philadelphia Meeting Features Films

Philadelphia, Pa.—The regular monthly meeting of the Philadelphia Metropolitan Chapter held Jan. 22, included an illustrated talk on Alaska by Louis Schneider, Deputy Commissioner of that city's Street Department. A sound picture, "A Bridge Is Born," was shown through the courtesy of the Delaware River Port Authority.

Corps of Engineers Program In Bay Area Explained

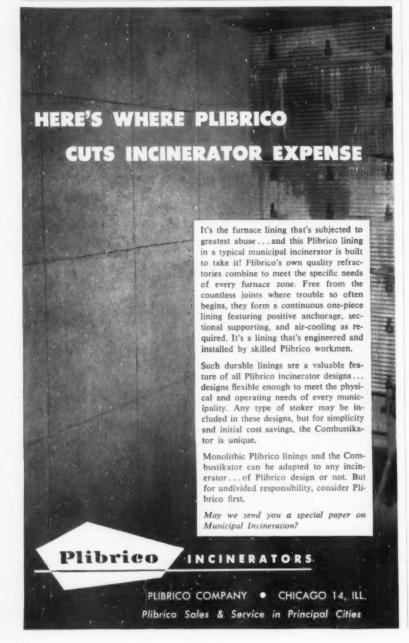
Oakland, Calif.—"The Corps' Current Program in the Bay Area" was the topic of guest speaker Col. John S Hartnett, District Engineer. Col Hartnett discussed matters in which the Corps can be of service to cities and counties, and how public works agencies can be of service to the Corps.

Detroit Area Development Told

Detroit, Mich.—The Decemb meeting of the Michigan Chapter heard Carlis J. Stettin, Director of the Port of Detroit Commission, outline Detroit Port Development. The January meeting featured film presentations on the Huron-Clinton Metropolitan Authority by Paul M. Reid, Executive Director of the Detroit Metropolitan Area Regional Planning Commission.

Airport Has Record Year

Sky Harbor Airport, Phoenix, Ariz., in 1957-58 broke all of its previous records with a continued increase in airport activities and revenues. Total airport revenues increased 24.5 percent over the previous fiscal year, from \$538,101 in 1956-57 to \$670,130 in 1957-58. The number of commercial airline passengers arriving at or departing from Sky Harbor increased 535,026 in 1956-57 to 628,908 in 1957-58, while aircraft movements increased to 310,400.





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NOTABLES OF THE MONTH

Jordan to Retire as AWWA Secretary; Faust Succeeds Him

Harry E. Jordan will retire on September 1 after serving nearly 23 years as secretary of the American Water Works Association. Raymond J. Faust, who has been executive assistant secretary since February 1951, was named by the board of directors to succeed Mr. Jordan, effective September 1.



Harry E. Jordan (right) congratulates his successor, Raymond J. Faust, as AWWA President L. S. Finch and Vice President L. W. Grayson look on.

Mr. Jordan, affectionately known as "Mr. Water Works," has seen the Association grow in the period of his office from 3,000 to over 12,000 members. Graduated with a BS degree in chemical engineering from Franklin (Ind.) College in 1903, he was awarded an honorary degree of Doctor of Science by it in 1938.

Walter Johnson Honored

At the Kansas Contractors Association convention recently in Kansas City, Walter Johnson, chief engineer for the State Highway Commission of Kansas, was presented the second annual Highway Award of "Kansas Construction Magazine." This recognition in the form of a bronze plaque was given him as the man judged to have done the most for the cause of better highways in that state last year. Along with his outstanding talents as an engineer, Mr. Johnson is widely known as an accomplished speaker on his favorite subject of Kansas highways.

Recognition for Alan M. Voorhees

Alan M. Voorhees, traffic planning engineer of the Automotive Safety Foundation, received the Highway



Alan M. Voorhees (left), as he was presented with the Highway Research Board Award by Prof. C. F. Scholer.

Research Board Award at that organization's 38th annual meeting in Washington. C. H. Scholer, retiring board chairman, made the award which was based on Voorhees' research report on methods of forecasting peak hour traffic.

Award to Gibbs and Hill

The New York firm of Gibbs and Hill, engineering consultants, has

Slurry-Seal Spreader



Gives best, uniform results with this NEW Method of surface sealing . . . thin, even application of asphalt-sandwater slurry. Fills and seals cracks. Levels minor depressions. Skid-proofs surfaces,

NEW TARCO Spreader made of aluminum structural shapes, bolted, forms light, yet rugged box. Two slurry-leveling blades: one semi-rigid; one flexible rubber adjusts to pavement contour by 5 screw-type rods. Completely equipped: heavy drag chains, 2 retractable traveling wheels; water sprinkler; telescoping tow bar; operator's cat walk.

For more spreader details—or more information on NEW Slurry-Seal Method see your TARCO dealer or write to us.

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- 7-Low operating cost
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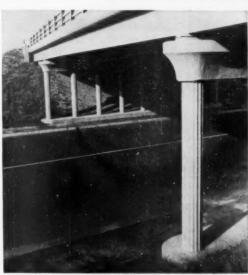
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Plant, Sales and Service: Green's Bayou, Houston 15, Texas Sales and Service Agencies throughout the Western Hemisphere been awarded the Department of Defense Reserve citation for its personnel policies of granting military leave with pay in addition to a regular vacation period. The citation states that its employees thus engage in reserve training activities without loss of salary and that the firm's cooperation has been of "significant benefit to reservists."

New President of ARBA

Nello L. Teer, Jr., president of the Nello L. Teer Co. of Durham, N. C., was elected President of the American Road Builders Ass'n. at the 1959 Convention in Dallas. Since its founding by his father in 1909 his firm has built more than 8,500 miles of highways in the United States and Central America, and was a joint venturer in airfield construction in Africa. Mr. Teer is a member of the Young Presidents organization and is vice president of the Durham and Southern Railway Co.

Estimating Population By a Density Factor

Population is estimated in Cuyahoga Falls, Ohio, by assuming that residence light meters are an accurate accounting of the number of family dwelling units in the city, as these represent duplex and multiple dwelling units as well as singlefamily ones. The census population for past years is divided by the number of light meters billed to give a density factor. This has declined slightly from 3.936 in 1930 to 3.74 in 1940 and 3.37 in 1950. Based on this rate of decline, it is estimated that the factor now is about 3.23, indicating a population at the beginning of 1959 to be 43,905. George F. Johnston is City Engineer.

Municipal Swimming Pool Construction in Wisconsin

According to the Wisconsin Municipal League, at least 25 cities in that state have constructed municipal swimming pools since 1953. There are now at least 57 pools in the State which provide filtration according to State Board of Health Standards. In addition to these pools having filtration equipment there are a number of municipal installations which do not use filters. It is reported that eight additional communities are in the process of constructing, or are giving consideration to building, municipal pools. These are Blair, DePere, Elm Grove, Fennimore, Neillsville, Sheboygan, Sturgeon Bay and Whitefish.

PUBLIC WORKS for March, 1959



LITTLEFORD clarkmoore HEATER-PLANER

Here is an increased maintenance program at no extra cost



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PAVEMENT



COST OF PLANING PAVEMENT



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The diagram at the left dramatically points out the increased maintenance program accomplished by the use of the Littleford-Clarkmoore Heater-Planer. As an example, your maintenance dollars will buy just so much "black-top". This "black-top" may be used either for a leveling course not needed to support the traffic or it may be used on additional streets previously planed by the Littleford Heater-Planer. Results . . . you cover twice the area as before.

The Littleford-Clarkmoore Heater-Planer can actually double your present maintenance program. How? . . . Quite simply! The Littleford heater-planer performs resurfacing operations heretofore impossible. It replaces excess leveling courses not needed to support traffic . . . money saved can be used in resurfacing other pavements . . . making possible the use of the same amount of maintenance dollars to fill a larger program.

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- ☐ HEATER-PLANER—Please send me at once—and without obligation—Littleford's heater-planer bulletin 18.
- □ TRAIL-O-PATCHER—Bulletin 28 describing the Littleford Model 700 Trail-O-Patcher as shown on the next page.
- □ KETTLES—Bulletin 1 describing the Model 84-HD-Tar and Asphalt Maintenance Kettle as shown on next page.

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CITY......ZONE__STATE___

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LITTLEFORD MODEL 700

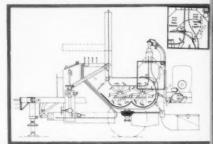
TRAIL-O-PATCHER BITUMINOUS MIXER . . . A small asphalt plant on wheels

No more delays waiting for trucks to return . . . no worries about the weather! The Model 700 is designed to produce a high grade bituminous mix . . . on the job, the year round.

> A completely self-contained unit: has twin shaft, heat insulated pugmill for drying and mixing the aggregate; its own 220 gallon heated bitumen supply tank and an accurate bitumen metering system. The 700 is the only mixer offering all of these facilities . . . It's ready for quick-fixing of any road, anywhere with less manpower, less cost and in less time.

> > DOWNER By Pass Heat

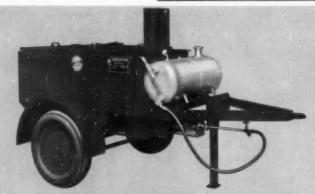
For additional informa-tion on the Model 700 mail the convenient reply card located at the bottom of this page.



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For additional information on the 84-HD Maintenance Kettle, mail the convenient postage paid air mail reply card at the bottom of this page.





PATENTED SCREEN RESERVOIR is formed by an inverted "V" shaped screen which keeps the cold material out of the bot reservoir.

PATENTED DOUBLE-HEAT CIRCULA-TION utilizes all the heat produced by the burners . . . uniformly distributes heat over entire melting surface of the inside tank.



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NEWS OF ENGINEERS

MEYER F. WILES, deputy commissioner of the New York City Department of Public Works, has been installed as president of the Municipal Engineers of the City of New York. EDWARD J. CLARK, chief engineer of the Dep't. of Water Supply, Gas and Electricity, received the Society's medal for the annual prize paper award.

LAUREN W. GRAYSON of Glendale, Calif., has been nominated president of the American Water Works Association; C. F. WERTZ of Miami, Fla., as vice-president; and W. J. ORCHARD of Wallace & Tiernan Co., as Treasurer. Mr. Grayson is chief engineer and general manager of the Glendale, Calif., Public Service Department; Mr. Wertz is director of the Department of Water & Sewers of Miami, Fla.

JOHN A. DONLEY has been made vice-president of Ken R. White Consulting Engineers, Inc., of Denver, Colo.

HOUGHTON R. HALLOCK has joined the Consulting Engineering firm of Gannett Fleming Corddry and Carpenter, Inc., Harrisburg, Pa., as Director of the General Engineering Division.

HUGO ERICKSON, who recently resigned as City Engineer of Minneapolis, Minn., has become a principal in the engineering and architectural firm of Magney, Setter, Leach, Lindstrom and Erickson, Inc., of Minneapolis, with offices in the Roanoke Building.

DONALD D. KING has been made Assistant to the Secretary of the American Society of Civil Engineers.

M. B. NIXON has been promoted to Assistant Chief of Construction, Atlanta, Ga., from engineer in charge of sewers.

EMMETT H. KARRER, professor of Highway Engineering at the Ohio State University has been elected president of the Educational Division, ARBA.

The following have been made Associates of Hazen & Sawyer, Consulting Engineers of New York City: C. Richard Walter, F. P. Coughlan, Jr., R. A. Papp, J. N. Rizzi, Jr., J. W. Neave and W. B. Sinnott.



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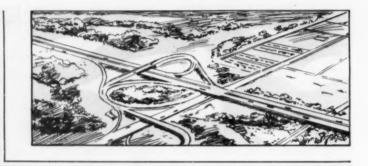
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Prepared by FRANK FORCE, Associate Editor

Penetration Macadam for Base and Shoulders

The pavement of the Taconic Parkway in New York comprises a 9-in, gravel subbase, 8-in, penetration base and a 2-course hot-mix pavement. The dual 24-ft. paved roadways have white portland cement concrete reflectorized curbs of rolled design. The subbase extends to the ditch lines, and the gravel base, 261/2 ft. wide under each roadway, is flanked by select granular shoulders. The 8-in. base was laid in two 4-in. courses with the first course being stone sizes of No. 3 and 4 crushed limestone; 2.0 gal. per sq. vd. of 100-120 penetration asphalt was applied in a single pass, followed by 50 lb. per sq. yd. of 1-in. max. crushed limestone. For the second 4-in, course No. 3 and 3A stone was blended and application of asphalt at 2.0 gal. was followed directly by the chip cover. Construction of 9-ft. shoulders on both sides of each roadway on the Berkshire Thruway consisted of a rolled gravel base and 4 in. of penetration macadam with choke and seal. The penetration was done in one course, applying 2.0 gal. of 100-120 penetration asphalt. Stone was a mixture of No. 4 and 3 state highway specification sizes.

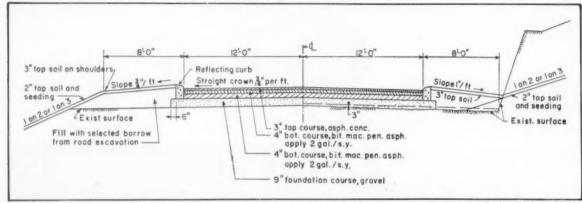
cover course consisted of 0.25 gal. per sq. yd. of 100-120 penetration asphalt covered with New York No. 1 (1 in. max.) stone, 30 lb. per sq. yd. Surface seal consisted of 0.33 gal. of asphalt and 30 lb. of chips per sq. yd. On the Cross Westchester Expressway shoulders along each side of the 9-in. x 24-ft. concrete pavement were specified to be built 8 ft. wide in two courses, the bottom course 4 ins. thick and the top course 3 ins. thick.

"How New York Uses Penetration Macadam for Base and Shoulders." Roads and Streets, January, 1959.

Street Maintenance Inspection Forms

The director of streets and the superintendent of streets in Peoria, Ill., make inspections of a general planning and supervisory nature and occasionally inspections of specific maintenance problems. The engineering aide makes technical and survey type inspections preliminary to programming detailed planning for work usually performed by contract. The street inspector inspects for need of tree removal or trimming and supervises the rubbish collection contract. The four foremen provide the greatest amount of

inspection, the day-to-day check for need and the follow-up check on work completed, each foreman generally inspecting maintenance requirements for his own divisional activity. On an emergency condition, no inspection forms are used as action is concurrent with inspection: however a formal or informal report may be made afterward. A special form is used on a citizen complaint to enable the department to record the problem, assign the proper person to inspect, insure that inspection and recommendation were made and determine that the problem was eliminated or the calling party contacted with an explanation of the situation. Inspection for program work is specific and it is detailed. It is made well in advance of the work. a season, at least. The data is gathered on a special form that provides full information for the office planning, layout and scheduling of a program and a contract, if that is used. Operators of street sweepers fill out a route sheet which designate the streets swept and a parking survey form which gives details on curb parking. A multilith machine is used to reproduce the forms on regular 81/2 x 11-in. paper. By the use of maps with various color fill-ins,



Courtesy Roads and Streets

• CROSS-SECTION of pavement with bituminous macadam shoulders on 8-mile section of Westchester County Parkway.

records of street maintenance and construction can be kept.

"Use of Street Maintenance Inspection Forms." By Leonard H. Caro, Director of Streets and Sewers, Peoria, Ill. Public Works, February, 1959.

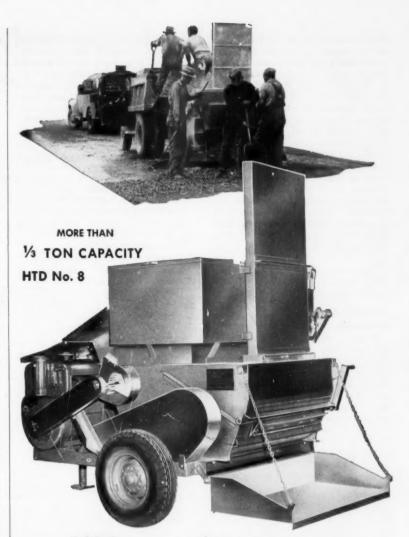
Precast, Prestressed Concrete Bridges

The Ottawa County Road Commission, Grand Haven, Mich., have adopted these qualifications in the design of their county highway bridges: The bridges shall be of simple design; provide low maintenance cost for economy over a long period of time; be easy to construct; be readily adaptable to future widening; be designed so that the stream can be lowered without affecting stability; and shall meet present and future traffic needs. The substructure units are composed of an abutment wall two feet in thickness supported on a single row of piling. The superstructure is of precast, prestressed concrete beams of the conventional square patented beam design to meet AASHO H15-44 or H20-44 loading. The beams require no painting and are durable and the superstructure can be easily widened. Most economical beam length is 45 to 50 ft. The tension steel wires are prestressed to 190,-000 psi and the concrete must have a minimum compression strength after 28 days of 5,000 psi. The concrete is placed at a temperature of not less than 50°F or more than 80°F. There have been six bridges built in the county with the cost per sq. ft. of deck running from \$11.34 to \$20.07.

"Precast, Prestressed Concrete Bridges for County Roads." By Henrik E. Stafseth, Engineer-Manager, Ottawa County, Grand Haven, Mich. Public Works, February, 1959.

Influence of Bypasses on Land and Business

The degree of impact on business activity of a community seems to be related to the extent and nature of the bypass. This is one of the conclusions reached in a study of the effects of a limited-access highway upon the business activity of bypassed communities and upon land value and land use, prepared by the Bureau of Business and Social Research of the University of Denver. The study is divided into two parts: Part 1 deals with the subject of impact of U.S. Routes 85 and 87 in Colorado on the business activity of certain bypassed communities:



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Part 2 deals with the subject of impact of sections of various highways in the area upon land value and land use. In several of the towns, sales of the automotive group have decreased because of the bypass largely as a result of a deterioration in business activity in service and filling stations. Food, furniture and general merchandise appear to be unaffected in most cases. Because of the scarcity of land, with access such as that provided by a major highway, it is reasonable to assume that land values and the land-use structure along an established, though improved, highway would not be affected as much by the improvement as land "opened up" by a new highway.

"Influence of Bypasses on Land and Business Activity." Better Roads, December, 1958.

Airphoto Analysis of Terrain

Airphoto interpretation techniques are especially useful for highway engineering terrain studies in wilderness areas where little or no detailed data on geology or soils is available. In Maine, time-consuming and expensive field reconnaissance surveys were reduced to a minimum

by the intelligent use of aerial photography. Detailed field investigation and laboratory testing are still required to obtain information for final design purposes, especially in critical areas. The Maine State Highway Commission has successfully employed airphoto interpretation techniques for obtaining a variety of information valuable in various phases of highway engineering. The four types of strip studies described in this article are only a few of many possible applications of this field. It is highly probable that more intensive and specialized photo interpretation studies will be made in the near future in Maine as well as throughout the nation.

"Airphoto Analysis of Terrain for Highway Location Studies in Maine." By Ernest G. Stoeckler, Airphoto Interpretation Specialist, University of Maine, and William R. Gorrill, Soils Engineer, Maine State Highway Commission. Public Roads, February, 1959.

Seattle Traffic Signing

Seattle, Wash., uses 140 different types of regulatory signs, 45 types of warning signs, and many other special signs to fit particular situations. By way of inventory, there are nearly 75,000 traffic signs in place, plus 54,000 street name signs, 16,000 traffic buttons, 4.500 reflectors and 1.200 channelizing islands and safety fences. All of these non-electrical traffic control devices are installed and maintained by 28 men in the Traffic Sign Shop of the Traffic Engineering Division. All the process screens and stencils used in painting traffic signs and also those used for painting street marking legends, are designed and constructed in the shop. A portion of the material from which traffic signs are made is salvaged from other signs that are obsolete but still in good condition. Several thousand cedar posts varying in size from 4 ins. x 4 ins. to 10 ins. x 10 ins. are processed each year. They are painted white with the exception of stop sign posts which are painted with alternate red and white stripes; and yield right of way sign posts which are painted with alternate black and yellow stripes. Approximately 10,000 signs are steam cleaned in place every year by using a "steam jenny" which is operated by two men.. Reversible lane operation is used to expedite traffic on a six-lane arterial street. Traffic cones and large overhead



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What characteristics should an effective traffic sign possess?

Broadly speaking, the answer to this question lies in investigation of 4 vital factors. As you may guess, the first of these is performance, far and away the most obvious sign feature to motorists. And, after this come the equally important economic considerations of sign fabrication cost, installation and maintenance ease, and durability, or useful length of life. Let's look at each more closely.

Performance

A motorist on the road after dark needs the help of traffic signs even *more* than a daylight driver. Accident statistics bear ments after the sun goes down is only doing 1/3 of its job. A modern sign should show all 3 to work for full-time safety at 100% effectiveness.

Effective communication in all weather is another desirable modern traffic sign performance characteristic. Federal Government specifications (military specification R 13689A) call for sign material that maintains at least 80% of dry reflection when subject to rainfall testing. The higher the percentage, the better the sign ... for again, motorists need the help of traffic signs most when driving conditions are the worst.

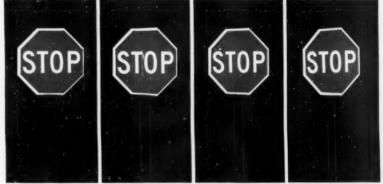
gives you this figure—(formed by dividing length of useful life into the cost of fabrication, installation and maintenance)—will minimize the true cost of communicating with the motorist.

Fabrication

Sign fabrication should be fast, clean and foolproof to insure uniform signing at lowest cost. Highest optical performance depends on a quality controlled sign material not subject to variations in technique or conditions such as humidity and temperature.

The material you choose will also provide more flexibility if it lends itself to both machine and hand application to any kind of backing. For further simplification, it should give you quick, easy refurbishing of old signs, flat or embossed, as well

These four primary factors and their parts, according to leading engineers, make up the characteristics an effective traffic sign should possess. How do you get all of them at once? We believe there is only one sign material which provides them all: "Scotchlite" Reflective Sheeting. This is the precision all-weather sign material that can give the performance motorists need, with the durability and ease of fabrication and maintenance that you demand



A sign of "Scotchlite" Reflective Sheeting performs without serious loss of brilliance through typical entrance angles of 0, 10, 20 and 30 degrees. Wide angle optical characteristics help compensate for road curvatures, installation inaccuracies and accidental or deliberate damage.

this out. With growing traffic volume—20,000,000 vehicles on the road after dark—the need for modern 24-hours-a-day signing cannot be denied. Whether the sign is a 24" x 24" curve warning or an 8' x 10' guide panel, reflectivity is a characteristic an effective sign must possess.



Brilliance of "Scotchite" Reflective Sheeting doesn't "black out," even in rainy weather. All-weather visibility of shape, color and legend means full-time traffic sign effectiveness.

Moreover, since the need for communication is greater after dark, the need to show all three elements of a traffic sign—shape, color and legend—is also greater. A sign that only shows one of these ele-

The final performance factor is angularity. Typical tests of sign materials at viewing angles of 0°, 10°, 20° and 30° quickly show that a truly effective sign material will retain high reflective quality through any angle of approach. It allows you to put each sign where it ought to be. Wide angularity gives you a measure of compensation for installation inaccuracies and for road curvatures. Also, if a sign is accidentally or deliberately twisted or bent, it will still communicate because wide angle reflectivity keeps the sign message from disappearing.

Durability

This is the first of the economic considerations. You naturally want signs that withstand weathering well enough to fit into your normal sign maintenance cycle. And you want reflectivity to remain high throughout the sign life so that effective communication with the motorist is not interrupted by decreased brightness.

Economy

For economy in effective signing, you want the lowest overall dollar cost consistent with desired performance and durability characteristics. The material that



Sign fabrication with "Scotchlite" Reflective Sheeting means professional results. Signs can be made in minutes by hand or machine.



See your 3M Representative soon and get more information on the truly modern effectiveness of durable traffic signs of "Scotchlite" Reflective Sheeting. Or write for details to 3M Company, Dept. QV-39, St. Paul 6, Minn.

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signs are used to control this reversible lane operation. Most of the overhead signing is illuminated and both plywood and metal signs are used with white lettering on a green background.

"75,000 Signs Guide Traffic in Seattle." By E. E. Lewarch, Traffic Engineer, and Earl Succo, Public Information Assistant, Seattle, Wash. PUBLIC WORKS, February, 1959.

Erecting Light Poles on Assembly Line Basis

The assembly line technique was used to speed the erection of a new lighting system on one of Chicago's busiest streets. Kil-Bar Electric Co. was given the contract to install and hook-up 1,050 new light poles and lamps. The assembly line method achieved a record in a single 10hour work day of 100 poles erected and 648 ballasts installed on erected poles. The working procedure was as follows: 1) Safety crew readies its barricades, pallets, flags and cones; 2) portable masonry saw cuts a 68-in. square, 1-in. deep notch into the sidewalk as a guide for the pneumatic hammers: 3) air hammers make full cut through the sidewalk; 4) vaults are constructed: 5) 20-in. diameter auger is used for digging holes; 6) poles are dropped at hole

by a self-propelled crane: 7) truck deposits pole equipment and supports: 8) two 2-man crews place equipment on poles; 9) pole is set; 10) ready-mix concrete is employed for the foundations; and 11) a selfpropelled aerial platform is used to lay the new wire. The company took all possible steps to avoid the removal of trees or cutting of branches. Concerning utilities, the rule followed was: "those who are in first have precedence." If the situation could be met by moving the pole a foot either way, this was done. If not, special measures had to be adopted.

"Erecting 1,050 Light Poles By High-Speed Assembly Line." Street Engineering, January, 1959.

Asphalt-Sand and Dredge-Placed Fill Go Into Highway

To make a four-lane divided highway through tidal marsh along the Delaware Dunes, the contractors used fill dredged from a bay bottom onto the right-of-way, three base layers of an asphalt-sand mix and a wearing course of bituminous concrete. The 5.6 miles of 18-ft. wide Delaware road were to be turned into four 12-ft. lanes with a 50-ft. median strip, 10-ft. outside shoulders

and 4-ft. inside shoulders. The contractor built 5-ft, high earth dikes along the entire length of the roadway These were to retain the watery fill until it had time to drain. Using a 12-in. discharge pipe, the dredge moved water-suspended sand and gravel at the rate of 200 to 300 cu, vds, an hour. The material produced a fill that averaged 3 ft. deep and required almost no compaction. However, in order for paying machines to work on top of the fill, a 4-in. blanket of compacted sand and clay was placed after the fill had been roughly shaped.. Three layers of asphalt-sand were laid down for the road base. The first two lavers were each 2 ins. thick, the third was 21/2 ins. A central plant prepared the mixture. A 11/2-in. course of high-type bituminous concrete was used as a wearing surface.

"Asphalt-Sand and Dredge-Placed Fill Go Into Highway." Engineering News-Record, January 8, 1959.

Approaches Toll Plaza and Electrical System

The approaches and toll plaza for the Mackinac Bridge were designed to utilize existing topographical features to the best advantage. The



north end of the bridge terminates at the end of a 3,600-ft, mole. Cuts as deep as 60 ft. were required to limit the upgrade of the roadway to three percent. The maximum downgrade is 3.1 percent. The south end terminates at a pier near the shore line of a park. A beam viaduct carries the bridge roadway across the park. There are five toll booths in a 92-ft, width of concrete payement. to collect tolls from six lanes. The toll islands are 6 ft. 5 ins. wide and the lanes between them are 10 ft. 1 in, wide. The toll plaza is about 700 ft. in length. The toll collection system is of the barrier type and cost of the system, booths and canopy was \$150,000. To illuminate the roadway and structure, six substations were built. The bridge electrical system is divided into two parts at the center of the main suspension span so as to provide light and power from two independent sources. When power fails, automatically controlled, gasoline driven generators, located at five substations, will provide emergency energy for the indispensable services. The mercury-vapor lights on the roadway are set about 155 ft. apart. staggered, on aluminum poles. At the toll plaza the lights are spaced 90 ft. apart.

"Approaches, Toll Plaza and Electrical System." By J. London, Associate Engineer, with D. B. Steinman, Consulting Engineer, New York, N. Y. Civil Engineering, January, 1959.

Streets Are Rainproofed

When heavy rains fell in the spring of 1957 in San Antonio, Tex., drainage facilities were inadequate and the streets eroded badly along the gutters. To solve these problems storm drainage is being provided in all sections of the city; and patching, seal-coating and reconditioning of a number of streets are underway. Patching and leveling is standard procedure preliminary to seal-coating to eliminate poor gutter lines and major irregularities in the streets. First job is to broom and clean the low areas and in some cases graders are used to blade off the high bumps. These areas are then primed with RC-2 cutback asphalt and built up with an application of hot plant-mix, cold-lay, asphaltic concrete. The material is then rolled and allowed to stand, preferably several days, before sealcoating. Colas, made by the Shell Oil Co., is used to seal the cracks and 0.18 gal. per sq. yd. is applied. Cover stone is applied at the rate FOR TRULY

UNDISTURBED SAMPLES

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The ability of the Acker-Denison Core Barrel to obtain undisturbed samples from sand, hard clays, silt and other difficult cohesive soil conditions accounts for its worldwide acceptance by Soil Engineers.

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While the basic features of the original Denison are duplicated in the samplers manufactured by Acker, numerous improvements suggested by Acker's 40 years of soil sampling experience are incorporated in the new Acker-Denison. It is these improvements that make the Acker-Denison even more useful and efficient than before!

Remember, no other manufacturer can offer the improved performance and exclusive patented features of Acker's new Denison Core Barrel. This proud achievement of Acker development and progress is exclusively Acker!

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of one cu. vd. for each 80 sq. vds. of surface. The stone is then packed by a pneumatic roller, broomed and compacted again with a steel wheel roller. In streets that are reconditioned, the existing base materials are utilized. 15 percent new base material is added and lithium gangue is the stabilizing agent. Graders scarify the streets, sheepsfoot rollers break the material down and the stabilizing materials are added and mixed-in-place.

"We Rainproof Our Streets." By Sam Granata, Jr., Director of Public Works, San Antonio, Tex. The American City, January, 1959.

Other Articles

"Specifications Can Accelerate Production and Quality Control in the Highway Program." Accelerated pro-cuction and quality control are the essential requirements in the highway program. By H. A. Radzikowski. Division of Development. Office of Operations. Bureau of Public Roads. Public Works, February, 1959.

"Yardstick of Highway Lighting." Lighting on the Connecticut Turnpike. By George A. Nazel, Electrical Consultant, Chester, Conn. The American City, January, 1959.

"Uneven Traffic Loads Call For Flexible Sewage Works." Some of the

service areas along toll roads function like miniature, self-sufficient towns, with their own water and sewage treatment plant. Engineering News-Record. January 9, 1959.

"System of Cost Accounting Helps Us Meet Goals." Change in budgeting control and cost accounting installed by Hennepin County, Minn., has benefited highway department and had profound effect on local-interest groups in county by making them aware of department's services. By L. P. Pederson, Hennepin County Highway Engineer. Better Roads, December, 1958.

"Overhead Signs." Standard plans are used for structures in California. By George W. Smith, Senior Bridge Engineer, and R. J. Israel, Supervising Highway Engineer, Calif. Div. of Highways, California Highways and Public Works, November-December, 1958.

"Training and Upgrading Inspectors." By Lester P. Landgraf, Senior Resident Engineer, District 20, Texas Highways, January, 1959.

"Freeway Model." Construction of complex interchange model is described. By Warren S. Ludlow, Bridge Architectural Associate. California Highways and Public Works, November - December, 1958.

"Central Plant Mixing Used on Soil-Cement Road Project in Minnesota." By Leroy Pehrson, Resident Engineer. Minnesota State Highway Dept. Rural Roads, January-February, 1959.

Sewer Cleaning and Debris Removed

. . .

A total of 68.082 feet of sanitary sewer were cleaned during the first eleven months of 1958 in Cuyahoga Falls, O., reports Geo. F. Johnston, City Engineer. Of this, 55,508 ft. were 8-in.: 6.531 ft. were 10-in.; and 6.043 ft. were 12-in. In all 44,460 pounds of material were removed, or about 2/3 pound per lineal foot.

Nevada Has Largest Highway Budget in History

A \$41,600,000 budget, the largest in the history of the Nevada Highway Department, has been approved for the calendar year of 1959. The expenditure will include over \$26,-000,000 for Interstate freeway projects, over \$9,300,000 for primary roads and over \$2,500,000 for secondary routes.

Highway construction is planned for roads in all 17 counties of the state with contracts totaling 288 miles. The new budget estimate also allows nearly \$3,500,000 for maintenance of Nevada's present 4,300 mile road system. Highway spending in 1959 will provide for construction of 121 miles of Interstate, 140 miles of primary and 47 miles of secondary

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tured above . . . also known as "Gutter-. is specially designed for vacvac . . . is specially designed for vac-uum cleaning street gutters. Mounted on a "Jeep" . . . for 1 or 2 man opera-tion . . the GJ-1 is a complete self-contained unit. Gutter litter is sucked up and blown into a large, heavy, burlap bag located in a dirt-filtered compartment. This unit is small enough to flow with traffic and do its clean up work as it goes . . . all for about 20c per curb mile. The "Gutter-Vac" is a handy, nimble unit that will gutter-clean where and when big sweepers can not work.

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STAND-BY PLANS

WILLIAM E. CROCKETT, National Disaster Office, U. S. Defense & Civil Mobilization, Battle Creek, Michigan

This paper was presented by Mr. Crockett at the APWA convention in Kansas City and has been condensed slightly here.

N THE world today major disaster may be unavoidable—but we have the capability to reduce the effects of disaster, to reduce the loss of lives, and to reduce hardship and suffering.

Streets and bridges are mainly susceptible to flood damage from wash-outs, surface or ditch erosion or subgrade saturation. Adequate original design and construction will, of course, minimize damage. But even those waterways or drainage channels designed to accept heavy streamflow may prove inadequate in major disasters. We may then be able to prevent washouts by emergency action. For example: Bridge washouts frequently result from the pressure of floating debris. In Dallas, Texas, in 1957, the Trinity River was jammed with debris, far too much to pass easily through the pier openings made smaller by the rising water. Drag lines were used to break up jams and to keep the debris from washing out sections of the bridge. Even if the bridge had been able to withstand the pressure, the clogged waterway might have backed up, endangering adjacent streets and buildings.

But bridges will go out, and streets will be blocked to traffic. Stand-by plans must consider these eventualities. What should be included in these plans? Reports from the New England floods of 1955 included these ideas:

When a bridge goes out or streets are blocked, a city may temporarily be divided into two or more isolated areas. The bulk of your operating force may be on one side of the river with no access to the other side. In anticipation of this, emergency units should be stationed on both sides of a threatened bridge. First aid teams, rescue teams, portable pumping and power equipment and other emergency units should be moved before the bridge goes out.

An emergency traffic plan should be developed so that traffic can be re-routed early enough to avoid serious traffic tie-ups. A plan for

emergency replacement of bridges should include what temporary crossing will be erected, where are materials available, who will construct the temporary bridge, etc. Other services may be affected if a bridge goes out, communications or power lines, water or gas mains.

A second category is debris removal. Debris may be silt, vegetation including trees, buildings, dead animals, rocks or other materials. There is little protection against this problem but it may be reduced by a continuing plan for removal of dead and damaged trees and substandard buildings.

Work Priorities

Stand-by plans should include inventories of equipment, manpower assignments, augmentation of regular departments with temporary employees or volunteers and zoning of the city into specific areas of responsibility for specific debris removal tasks. Do not overlook the necessity of assigning priorities of work. Debris which threatens health or safety should be removed first. Here the technical knowledge of health department personnel, sanitary engineers and others will be essential.

Trouble with sewage disposal plants arises primarily because of their location, usually in low lying areas adjacent to streams. Damaged electrical and pumping equipment, silting of filter beds and general plant destruction may occur. Sewer lines may be washed out, joints may be damaged, sections of the line may settle or portions of the system may be filled with silt. Protection of the plants may be accomplished by building dikes or river revetments. Also, if a sufficient warning period is available, the more vital equipment may be removed to higher ground as an emergency protective measure.

Even with precautions, the sewer system may be temporarily out of service. Sewer cleaning equipment should be available as well as adequate spare parts so that the more important functions of the plant can be resumed with a minimum of delay. A plan for emergency sewage disposal must be considered so that the health of the community will not be unnecessarily endangered. A thorough analysis of the entire system should be made to identify the most probable trouble spots and specific plans developed to restore or replace the portion most susceptible to damage.

Although water supply systems are not as susceptible as sewer lines,

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water lines may be washed out or polluted; units such as pump houses, wells, towers, and dams with appurtenant structures are subject to heavy damage. As with sewage plants, the primary means of protection of water supply works should be undertaken at the time of construction. In all cases, flood studies should be conducted prior to construction. Through these flood studies, the location and elevation of pumping plants can be determined as well as design criteria for dams and spill-ways.

Water supply systems are susceptible to damage and the normal sources of water supply may be lost from a disaster. Stand-by emergency plans must include continuation of the supply of water. Chemicals may be required for treatment. These should be maintained in a safe storage place. An inventory of alternate water supplies for temporary use should be undertaken. Private wells, stock ponds and neighboring communities are potential temporary sources. Portable chlorinators and water trucks may be required. Also, the public must be informed. What are the restrictions, where are temporary sources, who can use water? This, too, must be part of the plan.

Public buildings such as city halls, public schools, jails, etc., are susceptible to damage particularly when constructed in low lying areas. When these buildings are well-built they may not be damaged structurally, but the electrical systems, heating systems, elevator controls and plumbing are usually located in the basement. This means flood damage to these building facilities. In some cases this damage may be lessened by sandbagging around the buildings or by having available adequate pumping facilities to keep the water to a minimum depth. The best protection obviously, is to construct such buildings in non-vulnerable locations. Pre-disaster planning should include alternate sites so that immediate resumption of public functions is possible, even though one or more public buildings are unusable. Continuity of government is essential to organized disaster operations.

It might be interesting to check the location of your essential records. Are they relatively safe—or in a part of the building that will flood? In the Hurricane Audrey disaster the courthouse in Cameron, Louisiana, was flooded. The basement offices were almost completely inundated. Parish records, however, were kept on the second floor of the

building and the essential records were unharmed. If these records had been lost, the immense problem of establishing survivor claims and property rights would have been seriously complicated. In Lampasas, Texas, a levee break released a flash flood in the downtown area. The courthouse records were under water and a serious restoration problem resulted. The National Archives Service of the General Services Administration assisted in this restoration job, which was financed with Federal disaster assistance funds. Restoration of the records was accomplished but with considerable effort and expense. Records should be kept in safe locations and duplicate sets of essential records maintained.

Levees and drainage-ways are damaged primarily by floods, often because of lack of ordinary maintenance. Periodic inspection and maintenance of these facilities, even during extended dry periods, should be programmed. Dikes are often damaged by rodents and erosion. The flood capacity of drainage-ways may be seriously decreased through accumulation of trash and vegetation. It is much easier to fill gopher holes and clean ditches during a dry period than to wait until a disaster is about to strike.

Public utilities, such as electrical and gas systems are municipally owned in many communities. Plans should be available, not only for protection and rehabilitation of the system, but, even more important, for the protection of the community from fire and other potential dangers. It is vital to know the exact locations where power and gas mains can be shut off-and to have a plan to accomplish this-including who does the job, when and on what

authority.

There are certain general considerations to be applied to every emergency plan. Your pre-disaster planning should include the following: Communications; construction equipment and spare parts; location of equipment; manpower; maps; and recognition that disasters can happen to you.

Controlling Cutting of Curbs

Where a permit is granted to a property owner to cut curbs for driveways or drainage, the work is often poorly done and the curb damaged beyond repair. Cuyahoga Falls, O., now requires a payment of \$1.50 per curb foot and city forces do the work.



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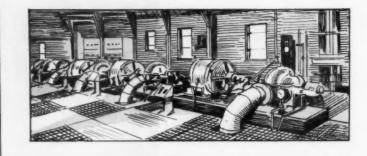
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Prepared by ALVIN R. JACOBSON, Ph. D

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Caracas Water System

The Rio Tuy-Mariposa water supply system in Caracas, Venezuela, completed at a cost of \$42,000,000 is one of the largest in South America. It consists of a feeder station and four main pumping stations which operate in a series and raise water a total of about 3,130 ft. The steel conduit is 18 miles long. The water is obtained from the Tuy River, which is dammed above Santa Teresa, about 15 miles from Caracas. The water flows first through three screen-protected intakes into a sluice chamber, and then through two 481/2-in. concrete pipes and into the two suction chambers of the riverside feeder station. Four vertical mixed-flow-pumping sets deliver the water into a supply conduit leading into three settling and desilting tanks. After 80% removal of the entrained substances the desilted water is then enriched with carbonic acid. Then chlorine is added to prevent algae growth before the water enters the Mariposa Reservoir which serves as a raw water reservoir for the filtration plant located about two-thirds of a mile farther down the valley. From the plant the filtered water goes into the city's

problem in the Rio Tuy-Mariposa system is to raise about 46,000 gpm of pretreated water to an altitude of 3,560 ft.

"Water Supply System of Caracas, Venezuela." By Joseph Sprecher. Jour. AWWA., January, 1959.

Ottawa's Annual Leakage Surveys

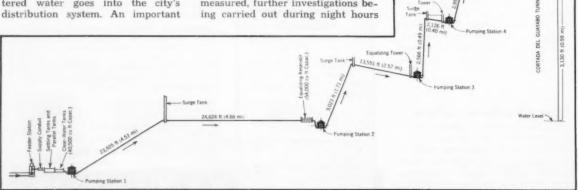
In order to meet increasing water demands, the City of Ottawa, Canada, adopted a comprehensive program of water conservation, including 100 percent metering of all customers to induce reduction of water waste, and annual pitometer surveys to reduce water loss in the distribution system. During the two years, 1953-1954, 26,700 meters were installed. The Pitometer Associates were engaged to carry out a pitometer survey in 1949, again in 1952, and each of the following years. As a result of these two projects the daily per capita consumption was reduced from 131.4 gallons in 1948 to 93.56 gallons in 1957, a reduction of 28.8 percent. For the purpose of the test the city has been subdivided into 27 districts. The consumption of water in each district for a full 24-hour period is first measured, further investigations bein those districts where excessive waste is indicated by the 24-hour measurements. The annual cost of the survey amounts to about \$20,000 and is considered a most necessary supplement to full metering in the control of waste water.

"Annual Leakage Surveys Reduce Water Losses 70% in 10 Years." By H. P. Stockwell. Water Works Engineering, January, 1959.

Water Supply Progress in 1958

In this article the author has cast a discerning eye at the progress in the water works field during the past year. Many of the problems of the industry have been discussed by reciting the experiences of some of the individual communities. One of the most spectacular developments was the installation of a plant for the conversion of saline water into a potable water for a municipality. The author is also keenly aware of the growing backlog of expansion,

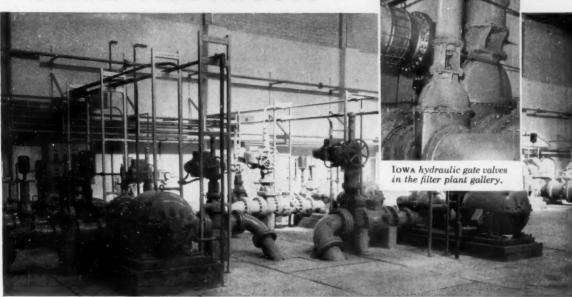
5,438 ft (3.11 mi



Courtesy Journal AWWA

● CARACAS water system, showing four main pumping stations which operate in series to raise water a total of 3,130 ft.

40 IOWA GATE VALVES...



IOWA motor-operated gate valves installed in the main pump station of North Texas Municipal Water District. (General Manager: Mr. A. P. Rollins; Consulting Engineers: Forrest and Cotton; Design Engineer: Mr. Ormond A. Stone.)

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The Filter Plant, located at Wylie, Texas, has a capacity of 20 million gallons a day. However, the design is such that it can operate safely at twice this amount. Water is delivered to the ten member municipalities and the City of Dallas through 90 miles of transmission line, ranging from 12 to 42 inches in diameter.

This Texas application is typical of the ability of Iowa to furnish gate valves to meet the most exacting specifications for plant and distribution service. Be sure and check the wide variety of Iowa valves, accessories and specialties before you place your order.

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replacement, and maintenance needs to provide the kind of service to which customers are entitled. Past droughts, recent water excesses, and the recession were not without their effect on the water works business and the cost of obtaining money for construction likewise is an important factor in future planning.

"Water Supply Progress in 1958." By Lauren W. Grayson. Water and Sewage Works, January, 1959.

Beaver Dam's Water Plant

The new treatment plant at Beaver Dam, Wisconsin, has an abundant supply of water, having two wells, slightly over 500 ft. deep, pumping water to the plant, and a third well which is connected to the distribution system and is used only in cases of extreme emergency. This modern plant assures delivery of iron-free, moderately soft water at adequate pressures throughout the year. It contains three filters, each having a daily capacity of 1.0 mg. The filter effluent flows to a 500,000-gallon clearwell. Besides measuring raw water, the control equipment records plant output and filter wash water. The new plant contains a modern meter repair shop, a combined office and laboratory, chemical feeders, and a completely enclosed chemical unloading bay. The total cost of the plant was about \$535,000.

'Beaver Dam's Water Department Meets the Challenge." By John R. Birch. The American City, January,

Instrumentation At St. Louis

In this paper the author discusses the progress being made by the St. Louis County Water Co. in the employment of special equipment and controls toward the fuller or better load factor use of its primary main system. Two of the installations are described in detail. Hydraulic schematic diagrams aid considerably in the discussion. Through a network of 1,750 miles of pipe, the system supplies water service to 140,000 customers residing in a 210-sq. mile area that borders the City of St. Louis on the north, south and west. Three municipalities purchase water for resale through their own distribution systems to 17,000 additional customers. These 600,000 people use almost 48 mgd on the average with maximum day water requirements of approximately 15 mgd and peakhour demand of 195 mil. gal. The system is supplied by three plants of 85, 36 and 15 mgd capacities and has a storage capacity of 26 mil. gal. of finished water in the distribution system. The author concludes that distribution system components, such as surface storage tanks and booster pumps, may be made fully automatic on an individual basis by properly designed controls, and important economies in transmission main investment and operating expense can be effected through their

"Progress of Controls and Instrumentation at St. Louis." By F. E. Dolson and H. A. Quade. Jour. AWWA., January, 1959.

Water Meter Maintenance

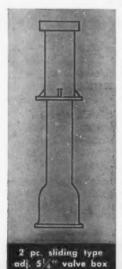
The author has described the necessary facilities for two "ideal" water meter maintenance shopsone for a small town and the other for a medium-sized town. The following factors must be borne in mind: 1) Number of makes and types of meters used, which affects the size of repair part stocks and the storage space for the parts. 2) Local water quality, which determines the extent of corrosion, liming or encrustment and wear. 3) Location and type of meter settings, which control the condition of the meter register and the outside of the casing. 4) In this era of rapid

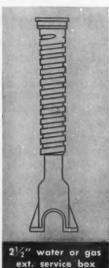


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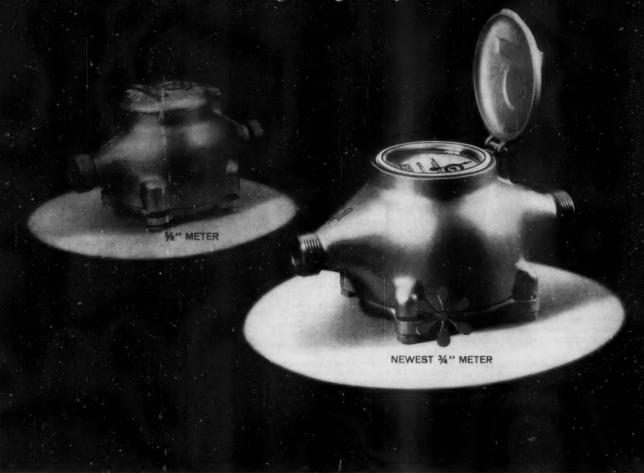
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- Operating cost compares favorably with conventional sand.
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Sparkler filtration engineers have introduced, in the RJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced developments in recent years.

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Sparkler Model RJ filters can supply practically any required volume of city water. Single units with a capacity of 2,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

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growth, facilities larger than really required at the time of first occupancy are usually necessary. Three important factors which must be considered in obtaining maximum efficiency from a water meter maintenance shop are: 1) Planning with regard to materials handling; 2) providing modern and sufficient equipment; and 3) considering the needs of the workmen. A meter shop layout planned in accordance with these principles can definitely save time as well as labor which means a saving in money. A set of recommendations are enumerated which will lead to the simplification of the physical work involved in good material handling practices. A detailed description of the operation of each of the "model" water meter maintenance shops is presented. The author concludes that regardless of the particular design, the repair shop will be efficient and economical if the three basic principles are fol-

"How to Plan a Water Meter Maintenance Shop." By Bernard Last. Public Works, February, 1959.

Rapid Sand Filters

In this article the author has presented a comprehensive discussion of the operating characteristics of rapid sand filters and the numerous factors which have an important influence on their operation. The condition of the filter bed is an important consideration for both the designer and operator in order that it may perform effectively. The author has divided filter bed troubles into two kinds: those that start at the top of the filter beds, and those that start at the bottom. The troubles that start at the top of the bed usually result from compacted flocculated material combining with filter media to form mud balls. These formations sink to the gravel layer during the washing process, where they combine with others to form a larger mass which causes maldistribution of backwash water and the displacement of gravel. On the other hand, trouble may start at the bottom of the filter because of uneven wash water distribution which may be the result of faulty underdrains or of the gravel layers. The author discusses the methods of preventing these troubles, such as improved design of underdrains. better pretreatment of the water applied to the filter, routine inspection of the filters, the characteristics of the filter media, and the backwashing process itself.

"Operating Characteristics of



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Rapid Sand Filters." By H. E. Hudson, Jr. Jour. AWWA., January, 1959.

Other Articles

"Laboratory Culture of Taste and Odor Producing Aquatic Actinomycetes." This paper describes some techniques and equipment designed for rearing the aquatic actinomycetes and the methods for the concentration and study of the taste and odor compounds. By J. G. Silvey and A. W. Roach, Jour. AWWA., January, 1959.

"Impoundment and Water Quality." A panel discussion presented on March 24, 1958, at the Southeastern Section meeting of the AWWA, Atlanta, Ga., Jour. AWWA., January, 1959.

"Water Supplies in the Central and Western Canadian North." This paper has covered some of the problems of water supply peculiar to the central and western Canadian North where permafrost exists throughout the year. By J. W. Grainge, Jour. AWWA., January, 1959.

"Rapid, Radioactive Test for Coliform Organisms". This is a status report on the investigations into the use of radio-isotopes for the rapid detection of coliform organisms by a direct confirmed test. By G. A. Levin, H. R. Harrison, W. C. Hess, A. H. Heim and V. L. Stauss. Jour. AWWA., January, 1959.

"Nature and Effects of Filter Backwashing". This is a report of extensive studies on filter backwashing made at the South District Filtration Plant in Chicago. By John R. Baylis. Jour. AWWA., January, 1959.

"Water Evaporation Control Research". This discussion is primarily confined to the application of monomolecular films to water surface to prevent evaporation. By Uel Stephens. Public Works, February, 1959.

"A Metropolitan Water Works Is Best." By Charles M. Bolton. The American City, January, 1959.

"Construction During 1958." The authors present here a brief review of the outstanding construction in the water and sewage fields during the past year on the west coast and in the east. By R. W. Simpson and R. W. Merz. Water and Sewage Works, January, 1959.

"Future Developments in Water and Sewage." The author has reviewed some developments in water and waste disposal, some of which may well be recent in 10 or 20 years from now. By George E. Symons. Water and Sewage Works, January, 1959.

"Glacial Drift in Buried River Basin Yields Safe Water Near Refuse Dump." The City of Rockford, Ill., makes the decision to construct an excellent yielding well in a buried river bed in the heart of an industrial area even though the area had been converted into a city garbage and refuse dump. By H. S. Merz. Water Works Engineering, January, 1959.

Accurate Colorimetric Determination of pH in Swimming Pool Water

A. E. GRIFFIN,

Chlorination Consultant, Wallace and Tiernan Inc., Belleville, New Jersey

This article is based on a paper presented at the Fifth Annual Swimming Pool Operators' and Managers' Short School at the University of Maryland.

THE DETERMINATION of the pH value is routine in the operation of swimming pools. When pool water is on the alkaline side of neutrality on the pH scale, smarting eye and chlorinous odor complaints will remain at a minimum. If the pH value is kept at an average of 8.0, these complaints practically disappear regardless of the magnitude of the chlorine residual up to an arbitrary figure of approximately 6.0 mg/L. It is thus very evident that the pH determinations should be as nearly accurate as is practical.

The colorimetric pH test is performed by adding certain organic dyes called indicators (each one having a specific pH range) to a water sample. Those used in swimming pool operation are bromthymol blue on phenol red. The developed color should be clear and strong and should have the same color, intensity, and hue as the prepared standards.

When it is difficult to judge which standard the developed color most nearly matches or when it is immediately evident that the color is not even near the standard color either as to intensity or hue, then action should be taken to find out why

Such deviations from normal in development of the proper color with any given standard pH indicator solution can be caused by any one or any combination of the following reasons: 1) Wrong concentration of indicator solution; 2) the use of too little or too much indicator solution; 3) incorrect volume of sample; 4) incorrect viewing depth; 5) contamination of indicator solution; or 6) presence of free chlorine or chloramine residual.

The first, second, and third relate to the volume of indicator solution in relation to the volume of the sample. The fourth relates to the depth of the sample in the area where the color comparisons are made.

The color produced when pH indicator solutions are added to water is composed of a certain number of color molecules. For example, if the directions call for the addition of 0.75 ml to a 15-ml sample in a cell of 26mm viewing depth, and if the viewing depth is decreased from 26mm to 13mm without changing the volume, then the number of color molecules between the eye and the light source will be decreased by 50 percent and the observed color will be 50 percent weaker than it should be. The same would hold if the viewing depth were kept constant and the volume increased to 30 ml without increasing the application of the indicator solution.

All pH indicator solutions contain sterilizing agents such as alcohol or formaldehyde which prevent the growth of bacteria which might weaken the indicator strength. The presence of "fuzz" in the bottom of the indicator bottles means the bacteria are working. The remedy is to discard the bottle and contents.

The greatest single influence on the accuracy of the colorimetric determination of pH in swimming pool water is residual chlorine, particularly when it is present as free available chlorine, which is a powerful bleaching agent and has a high oxidation potential. Bleaching of color in water or fabrics is a form of oxidation.

Chlorine in concentrations as low as 0.2 mg/L will slightly bleach bromthymol blue and phenol red. In some waters the effect of 0.2 mg/L chlorine will be barely noticeable. In other waters this same amount of chlorine will change the color and subsequent reading as much as 0.5 of a digit, as from pH 7.4 down to 6.9.

When about 1.0 mg/L chlorine residual is present the developed or developing pH indicator color may be bleached so rapidly that the remaining color bears no relation to the standard color. When bromthymol blue, for instance, is added to

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PUBLIC WORKS for March, 1959

a sample, blue or greenish tendrils may develop near the surface and tend to sink and curl downward. But the minute the sample is disturbed, the sample becomes straw colored. This usually is evidence of chlorine at work.

The remedy is to add a few crystals of sodium thiosulfate to the sample prior to the addition of the pH indicator. The number of crystals is not critical but it is always wise to avoid a large excess. The reaction between chlorine and thiosulfate has no appreciable effect

on the pH of the water. Crystal thiosulfate is preferable to liquid thiosulfate because the crystals do not lose strength; they can be carried in the pocket without danger of spillage; and they do not introduce a dilution error which could give misleading results.

Other dechlorinating agents could be used but are generally avoided either because they change the pH of the sample, are not readily available or are subject to deterioration or other chemical changes which makes them difficult to use.



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These facts have been amply proved in the many municipal filtration systems now in operation, many of whom depend on Dicalite Filteraids to deliver pure drinking water to their communities.

For more complete information on the use of Dicalite Filteraids in municipal water supply, write for our Bulletin BW-13.



DICALITE DEPARTMENT, Great Lakes Carbon Corp., 612 So. Flower St., Los Angeles 17, Calif.

SEVEN YEARS OF METER MAINTENANCE SHOW PROFIT

BACK in 1951, J. Elliott Hale, superintendent of the Kennebec Water District at Waterville, Me., wondered about the revenue from the district's 15 large meters. His questions stemmed from a survey made by the Pitometer Company which showed that large quantities of water were not being accounted for. As a result, Mr. Hale called on the Hersey Manufacturing Company for assistance, and a representative, together with a member of the company's service department, visited each meter installation, checking the operation and testing wherever possible.

The survey showed that six large meters some of which were manufactured as long ago as 1919, were losing registration at a cost to the district of \$360 per month. In one case, the meter was registering less than 50 percent, costing the district \$1,930 in an 11-month period.

The report made by the Hersey representative recommended that the six meters (three 6-in. and three 8-in.) be replaced with new meters at a cost of \$6,497.60. It pointed out also that some of the meter installations should include compound instead of disc meters on the by-pass in order to measure the very low flows. It further suggested that all other large meters be repaired and brought back to the AWWA and the NEWWA specifications as to test. This was done and in two years the expense of carrying out these recommendations was paid in full from the added revenue received as a result of accurate registration on properly metered lines.

With the Kennebec Water District operating under a new-found rate of efficiency on large service meters, Mr. Hale felt that this level should be maintained. Consequently he again turned to the Hersey company for its advice. Its experts recommended that large meters should be checked and tested at least once a year; and further that he purchase a large-meter testing outfit and train one of his men in its use. However, Mr. Hale felt that a more efficient operation would result if the Hersey serviceman made periodic tests on the meters. In the event a customer questioned the registration of a meter the record of testing would be produced. If the customer still doubted the meter he had the right to insist on a test by

the factory serviceman. Should the meter prove wrong the water district would pay the service charge. On the other hand, if the meter was registering properly the customer would pay the service charge.

Large meters are given a thorough inspection once a year and their operation checked twice a month. Commercial (2-in.) meters, such as are used for schools and dairies, are inspected every two to five years; residential meters are inspected every ten years.

Since the original survey made in 1951, a Hersey serviceman has returned each year; he completes the job of testing all large Hersey meters in one week. The establishment of this fine meter program is a tribute to Superintendent Hale. Under his guidance this seven-year program has added many thousands of dollars to the water district's annual income.

Waterville, with a population of slightly more than 18,000, is situated on the Kennebec River in South Central Maine. Its varied industries manufacture pulp, cotton goods, worsted cloth, paper plates, shirts and fibre. There are also a number of smaller food processing plants. These industries use 64 percent of all the water. One firm alone, the Keyes Fibre Company, uses 2,000,-000 gallons daily. At present the Kennebec Water District is 96 percent metered and last year pumped 1,884,922,600 gallons of water through 5,866 meters.

The Kennebec Water District is the oldest water district in the country, having been organized in 1899. It is administered by a board of five trustees, employs 20 persons, and in 1957 recorded an annual revenue of \$192,817.43 from water services.

Tests Show Uniformity of Fluoride Ion Levels

A study was made of the fluoride ion levels in the Rahway, N. J., water supply by W. H. Aaroe, principal public health engineer of the New Jersey State Department of Health. This showed that 88 percent of the samples of delivered water at the plant showed fluoride ion levels within 0.1 ppm. of the average of 1.1 ppm. It appears that confidence in the ability of present feed machines and engineering practice to provide accurate, precise fluoride levels is justified.

In spite of the complex situation brought about by the admixture of non-fluoridated well water in varying ratios, the average calculated fluoride ion content of the

water during the test period was 1.04 ppm, while the average fluoride level of all the distribution samples was 0.99 ppm. The difference of 0.05 ppm. is considered negligible and is one-half of the sensitivity of the fluoride determination (0.1 ppm). The average concentration of fluorides at the dead end (1.02 ppm), at a small user (0.97 ppm) and at a heavy user (0.98 ppm) vary between 2-3 percent of the average (0.99 ppm) for all distribution samples and exhibit no definite trend. It is concluded that there is no evidence of fluorides being deposited in the system.

Samples were collected by City of Rahway Water Department personnel, under the author's direction, three times weekly (Monday, Wednesday, and Friday) during the period from 28 February to 12 July, 1957. All analytical work was performed by the Bureau of Chemistry, Division of Laboratories, at the State House, Trenton.

Fluorides were determined by the Scott-Sanchis Method with fresh wet standards made each time a group of samples was run; pretreatment did not include distillation but did include chlorine removal when necessary.



To appease the GOD OF FIRE

Vulcan was the Roman God of Fire and each year on August 23 Roman families threw fish into a fire as a sacrifice to appease his anger. From the earliest dawn of civilization, fire has been to Man both friend and foe. In modern times, municipal fire fighting has long been a matter of an efficient fire department and an adequate water supply. This is where the water works man enters the picture.

On water depends the safety of human life and property—and lower fire insurance rates. The first fire-engine pump mentioned in history was used in Egypt in 200 B. C. Great and marvelous improvements in fire fighting equipment have been made in the past

22 hundred years. But all such equipment would be useless without water. A modern fire department in action is a spectacular performance. But it is the water works man "behind the scenes" who makes it possible. Give him some of the credit.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE



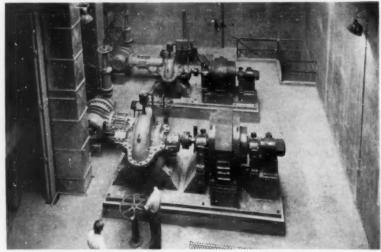
NEW SOURCE DOUBLES AVAILABLE WATER SUPPLY

THE AVAILABLE water supply in the Niles and Youngstown, Ohio, area has been doubled by completion of a new intake tower and pumping station at Berlin Dam on the Upper Mahoning river. Placed in service by the Mahoning Valley Sanitary District, the new facilities were built by Dravo Corporation of Pittsburgh. Up to 30 million gallons of water per day will be available. The water system presently serves 200,000 persons in the Mahoning Valley.

From the dam, water is pumped through a 9-mile pipeline into Meander Creek, which flows into Meander Reservoir, the district's present water source. The Meander Reservoir, which has a yield of 30 mgd, is inadequate to meet the area's growing needs. With the water from the Berlin Reservoir, the Sanitary District's daily capacity has been increased to 60 million gallons.

Based on population forecasts, the area will need 35 mgd by 1960; by 1970, the need will rise to 45 mgd; and a peak of 60 mgd is foreseen by the year 2000, when the population of the area is expected to be 350.000.

The new intake tower, an ovalshaped structure of reinforced concrete, was set in a cellular steel sheet pile cofferdam 45 feet upstream of the dam. From top to bottom, the tower measures 75 feet, twothirds of which will be covered in high water. In cross-section, it is approximately 30 feet by 38 feet. Capping the tower is a one-story brick building.



PUMPING station at Berlin Dam showing two pumps which deliver water through a 9-mile pipe line to Meander Reservoir. The new facilities double present capacity.

Water enters the intake tower through 4-ft. by 6-ft. slots, per mitting withdrawal of water at various depths. A 19-ft. wide intake channel, cut through solid rock, carries water into the tower. A 66in. diameter steel pipe, entrenched in rock and encased in concrete, carries the water 285 ft. from the tower to the pump house downstream. Built on a reinforced concrete base, the pump house is a one-story brick building, 20 ft. high, 77 ft. long and 44 ft. wide. The base is set 46 ft. underground, more than 20 ft. in solid rock.

The pump house contains two DeLaval single-stage, centrifugal pumps. One of the pumps, powered by a 1000-hp Westinghouse motor, has a capacity of 20 mgd. The other, driven by a 500-hp Westinghouse motor, has a capacity of 10 mgd. The pumps operate against a 230-ft. head.

Although the Berlin Dam was not designed to serve as a water supply, such use was anticipated when the structure was built in 1940, by the Army Corps of Engineers. A passage was left at the base of the dam, and through this opening runs the pipe connecting the intake tower and the pump house.

In addition to the intake tower, the pump house and the connecting pipelines, Dravo installed a structural steel bridge from the top of the tower to the top of the dam. Also constructed was a mile-long access road, which connects with an existing highway.

The entire project, including the nine-mile pipeline, which was not part of the Dravo contract, was designed by Parsons, Brinckerhoff, Hall and MacDonald, New York consulting engineers, in cooperation with Luther T. Fawcett, chief engineer of the Sanitary District.

Funds for the Berlin Dam project were obtained from a \$6,000,000 bond issue floated by the Mahoning Valley Sanitary District in 1956. Directors of the District are A. I. Kidston, of Youngstown, and Walter F. MacQueen, of Niles.



INTAKE tower, with Berlin dam shown at right, is oval-shaped, surmounted with brick building. Dimensions are about 30 by 38 ft. Bridge connects tower to top of dam.

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2= Cut out section of main with Mueller Drilling Machine.



3. Lower valve plug assembly into main and secure.



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SEWERAGE AND REFUSE DIGEST



Prepared by ALVIN R. JACOBSON, Ph.D

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Water and Sewage Research in 1958

In this article the author presents a summary review of the research activities in the water and sewage fields under way in laboratories in treatment plants and in other areas throughout the United States. According to a preliminary survey there are some 300 individual projects involving water, sewage and industrial wastes studies. These research projects are divided into the following categories: Methods of obtaining, conserving, treating, testing and using water; methods of treating sewage and industrial wastes; methods of assaying waste materials; and final effluent disposal methods. An excellent bibliography of 54 references is included.

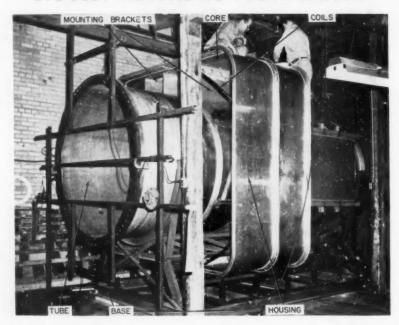
"Research Progress in Water and Sewage." By Harry A. Faber. Water and Sewage Works, January, 1959.

What To Do With Supernatant?

In the digestion of sewage sludge or organic solids, the characteristics of the digester supernatant are governed by the efficiency of the process and the properties of the materials added to the digester. In this article the author reports on the application of a number of methods in his investigation of the problem of digester supernatant treatment. A brief discussion of each of the following methods is presented: Chlorination; nitrate treatment; aeration; activated sludge process; lime-ferric chloride treatment; vacuum filtration; organic flocculant treatment; lagooning; surface-aerated lagooning; lagooning with nitrate-lime; biofiltration; pressurized air flotation; and centrifugation. The author concludes that: 1) When the digester supernatant contains low suspended solids and BOD, it can be treated together with plant influent by trickling filtration or the activated sludge process. 2) When the digester supernatant contains high suspended solids and BOD, it should be treated separately before attempting to add it to the plant influent. 3) Surface-aerated lagooning—with or without nitrate and lime treatment—may be of economical value in stabilizing the digester supernatant liquor. 4) Chemical

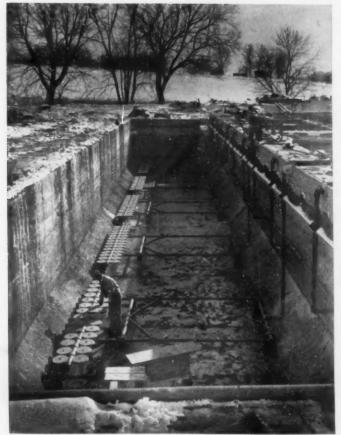
coagulation with organic or inorganic compounds, followed by vacuum filtration, totation, centrifugation and clarification, can be successfully employed to reduce the suspended solids and BOD of digester supernatant if there is sufficient volume to warrant such practice. 5) Chlorination can be economically practiced when the

BIGGEST MAGNETIC FLOW METER



N-CONSTRUCTION view of the world's biggest Magnetic Flow Meter, a 72-inch diameter instrument built by The Foxboro Company for the new Pittsburgh, Pa., sewage plant of the Allegheny County Sanitary Authority. Installed in the main influent tunnel, the meter will measure raw sewage flows of up to 350 mgd. Flow through the meter tube is measured

electromagnetically, with electrodes sensing the voltage generated by the liquid moving through a magnetic field. Receiving this voltage is a Foxboro Dynalog Recorder which logs flow data vital to plant operation. Since the meter puts no restriction in the line, no pressure drop is added. Consulting engineers for the new plant are Metcalf and Eddy, Boston, Massachusetts.



Here is one of the aeration tanks in Kewanee, Illinois, using the P.F.T. Dual Aeration Equipment. Crayford, Murphy and Tilly, Consulting Engineers, Springfield, Illinois.



Note P.F.T.'s removable aeration plates which permit service without shutdown.

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PORT CHESTER, N. Y. . SAN MATEO, CALIF. . CHARLOTTE, N. C. . JACKSONVILLE . DENVER

suspended solids concentration in the digester supernatant is reasonably low.

"What to Do With Supernatant?" By Dr. R. H. Howe. Wastes Engineering, January, 1959.

Forty-Year Sewerage Plan

The Howard County, Maryland, Master Plan Sewerage Report which was recently completed may be one of the most comprehensive sewerage reports ever made for a county commission because it is countywide. The anticipated sewerage

needs of a 253-square-mile area during the next 40 years were considered. In addition, the recommended construction will be fully coordinated with sewerage plans of adjoining counties and sewerage authorities. The system will include about 140 miles of piping and 17 pumping stations. The report tentatively recommends that Howard County collect and drain all its sewage into the sewerage system of Baltimore County for conveyance to the City of Baltimore for final disposal. A small amount originating in the Patuxent drainage area

could be discharged into the sewerage system of the Washington Suburban Sanitary Commission for disposal at the Commission's new Laurel Sewage Treatment Plant. The estimated cost for the sewerage system is \$24,350,000 to be financed partially through the issuance of \$6 million of general obligation bonds, an ad valorem tax at the rate of 15¢ per \$100 of assessed valuation, an interceptor connection charge of \$250 per house, a minimum sewer service charge of \$5 per quarter per residential customer or 100 percent of the actual water bill, whichever is larger.

"Forty-Year Sewerage Plan for a Metropolitan County." By Kenneth A. McCord. Public Works, Feb-

ruary, 1959.

New Sewage Plant at Boulder, Colorado

The construction of a new complete treatment plant and outfall sewer has solved the sewage treatment problem for Boulder, Colorado. Studies made in 1955 disclosed that the new outfall sewer should be adequate enough to carry a maximum flow of 14.5 mgd from a population of 60,000 and that the plant should be so designed as to permit additional construction if the need presents itself. Three turbine-type pumps recirculate sewage through the plant to maintain minimum flows. The separate-sludge-digestion type plant provides secondary treatment with high-rate trickling filters. In addition, plant effluent is chlorinated. A two-story control house, located between the two digestion tanks, houses the raw sludge pumps, sludge circulating pumps, sludge heater, laboratory and office. A separate building near the final sedimentation basin houses the circulating sewage pumps and chlorinator. The various plant units, their size and type of equipment are described in a table.

"New Sewage Treatment Works for Boulder, Colo." By G. R. Scott. The American City, January, 1959.

MPN and MFC

In this article the author reports on a comparative study between the membrane filter and fermentation tube techniques in the estimation of coliform densities in sea water or sewage-sea water mixtures. The work comprised the following experimental studies: 1) The examination of two groups of surf water, totalling 695 samples, by the two methods in parallel. 2) A series of 28 experiments run in parallel on



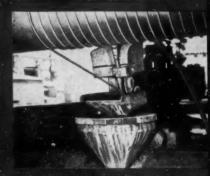
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receive these plus factors feature III American — where research, development and quality equitod are always for striving to make their quality broducts even better.

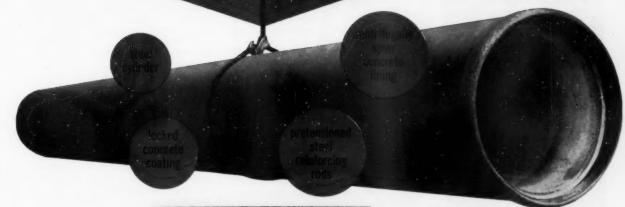
American Concrete (S. Reier Pipers) vailable in a dismeter in 1911 P. Brown 107 (Dianol in standard lengths) of trees.



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settled, strained, diluted sewage. 3) A series of eight experiments in parallel made on diluted broth cultures of coliform organisms. 4) A short series of tests to determine the proportion of false-positive BGB tubes obtained from sea-water samples. A study of the data has led to the following inferences: 1) The membrane filter method of estimating coliform densities in sea water and sewage-sea water mixtures has advantages over the fermentation tube method by virtue of the labor, time and materials saving. 2) The results of the membrane filter test are available earlier, and consequently, are of more value in a control program. 3) The precision of the membrane filter count is superior to that of the most probable number derived from fermentation tube results. 4) In a limited number of replicate tests on samples containing only coliform organisms, the membrane filter count was in better agreement with the total count than was the most probable number.

"Studies On the Use of Membrane Filters for the Estimation of Coliform Densities in Sea Water." By W. L. Henderson. Sewage and Industrial Wastes, January, 1959.

Salmonella in Digestion

In this second article of the present series the authors show the effects of the major environmental and biological influences on the growth of S. typhosa in anaerobic digesters. In addition, they present the mechanism involved in the survival of this bacterium in this sewage treatment process. The authors conclude that: 1) Salmonella typhosa grows readily in culture media at ORP (oxidation-reduction potential) levels normally found in anaerobic digesters. 2) Raw sewage sludge is a potentially adequate source of food for S. typhosa. 3) A. aerogenes, E. coli, and Ps. fluorescens complete with the typhoid organism for essential food in the sludge and the former are more successful than the typhoid bacteria in the competition. 4) The gaseous anaerobic environment tends to suppress the growth of all the organisms studied. 5) Bacteriophages and antibiotic substances in the sludge have no effect on the survival of S. typhosa. 6) The failure of S. typhosa to survive in anaerobic digesters appears to be caused by a limited food supply and a predominance of other organisms which successfully compete against the typhoid bacteria for food. 7) The mechanism of survival

of *S. typhosa* in anaerobic sewage treatment processes depends on the organism's ability to acquire the amino acid tryptophan which is essential to its growth and survival under these conditions.

"Survival of Salmonella Typhosa During Anaerobic Digestion." II. The Mechanism of Survival. By H. E. Langley, R. E. McKinney and H. Campbell. Sewage and Industrial Wastes, January, 1959.

Incinerator Utilizes Effluent

The unique features of the new Bostwick Avenue Incineration Plant. in Bridgeport, Conn., which lends to better refuse disposal are: Use of sewage treatment plant effluent for residue quenching, fly ash control, and other plant uses not requiring potable water. The Nichols Wetscrub fly ash control system consists of water-sprayed, stainless steel, vertical baffles in a spray chamber. The sloping floor is covered with water and spray jets. A main air duct across the building is dampered so that combustion air, whether natural or forced draft, can be taken from the outdoors, from the upper storage bin or from the lower ash room as desired. The extra large, doubleleaf charging gates eliminate arching in the charging hopper. Since the plant has been in operation, it has averaged a 90% rating five days per week and generally exceeds the 300-ton rated capacity on Mondays and Tuesdays. The new plant supplements an old plant of 150-ton capacity which is to be modernized, after which it will handle 1/3 of the material and the balance will be handled by the new incinerator.

"Bridgeport Incinerator Utilizes Sewage Plant Effluent." The American City, January, 1959.

Septic Tank Effluents

A radically different design in which the distribution box is eliminated has now been proposed as a result of studies financed by the Federal Housing Administration and conducted by the Robert A. Taft Sanitary Engineering Center of the Public Health Service. The study entailed the examination of over 3,000 individual septic tank systems. After analyzing the performance data from over 1,600 systems, it was concluded: 1) That distribution boxes could be eliminated from septic tank soil absorption systems in favor of some other method of distribution without increasing the failure rate of disposal fields. 2)



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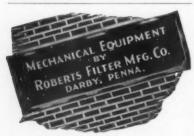


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Data indicate that on level ground, equal distribution is not necessary if the system is designed so that an overloaded trench can drain back to the other trenches before failure occurs. 3) On sloping ground the method of distribution must prevent excessive build-up of head and failure of any one trench before the capacity of the entire system is utilized. 4) Before attempting to perfect a device necessary to accomplish equal distribution with its consequent increase of control and inspection, a comparison of equal distribution with serial distribution is desirable. Serial distribution in an absorption system is accomplished by the use of separate trenches connected in a series. All of the effluent is discharged to the first trench and an overflow line is arranged so that the trench is forced to pond to the full depth of the gravel before liquid flows into the second trench. The overflow line lies below the surface of the ground on undisturbed earth, and is arranged to give relief before liquid seeps to the surface. Succeeding trenches come into play in serial sequence so that the total absorption area of the entire system is utilized before final failure can occur. The use of serial distribution systems will result in a reduction in the installation costs of approximately \$15 to \$30 per system. The saving to home owners as a result of better performance and fewer failures is difficult to estimate but could amount to many times the original saving.

"Serial Distribution of Septic Tank Effluents. By J. B. Coulter and T. W. Bendixen. Public Works,

February, 1959.

Big Pipe Job Eases Sewer Problems

A \$50,000,000 sewer program will soon be completed by the Indianapolis Sanitary District which will eliminate costly overflows of inadequate sewers and pollution of the White River. Another \$7.5 million has gone into expansion of sewage treatment plant capacity to 120 mgd. More than 50 miles of precast, reinforced concrete pipe for both sanitary interceptors and storm sewers will be laid with 20 miles of this pipe ranging in diameter from 5 to 9 feet. The tunneling and pipe laying operations are described. The project was financed through the sale of bonds.

"Big Pipe Joh Eases Indianapolis Sewer Problem." By James C. Courtney. The American January, 1959.

Other Articles

"Sewer Service Charges Pay For Arkansas Sewage Works." Sewer revenue bonds are used almost exclusively because constitutional limits make ad valorem tax bonds impractical. By Marion L. Crist. Wastes Engineering, January, 1959.

"Sewer Inspection by Closed Circuit Television." Closed circuit television is being used to inspect the sewer system of the City of Cincinnati at a considerable saving in personnel and money. By A. D. Caster. Public Works, February, 1959.

"Composting Municipal Refuse." This is a report on an investigation, including first-hand visits to European installations, of this problem. By John B. Nesbitt. Public Works, February.

Marine Waste Disposal

The First International Conference on Waste Disposal in the Marine Environment will be held by The University of California, at Berkeley, Calif., during the summer of 1959. The three-day meeting will provide a forum for the international exchange of knowledge among scientists, engineers and organizations who are concerned with marine pollution research throughout the world.

A tentative agenda lists as discussion topics (1) Waste Disposal (2) Health (3) Nearshore Public Oceanography (4) Receiving Water Analysis (5) Marine Biota and (6)

Estuarine Hydrography.

The program is presented by the U. C. Sanitary Engineering Research Laboratory, the Institute of Marine Resources and University Extension in cooperation with the California State Water Pollution Control Board. Conference chairman is Erman A. Pearson, associate professor of sanitary engineering at the University and chairman of the Research Consulting Board of the State Water Pollution Control Board.

This conference will provide the first opportunity for an international exchange of information on marine waste disposal. Although a great deal of industrial and municipal waste is discharged into the marine environment, research in this area has been largely neglected as compared to research on the fresh water environment. In California alone, more than 125 communities discharge waste materials directly into coastal and estuarial waters. The conference will provide an opportunity for a more scientific appraisal of the problems arising from this disposal practice.

Urban Communities and The Roadbuilding Program

More than 50 top federal and state highway officials, city administrators, housing officials, and civic leaders have released a plan for coordinated action to obtain maximum benefits for urban communities from the U.S. roadbuilding program. During the National Conference on Highways and Urban Development, sponsored by the Committee on Urban Research of the Highway Research Board, the American Municipal Association, the AASHO Joint Committee and Syracuse University, the assignment of responsibilities among all the various groups directly concerned was agreed on.

The Conference was held at the Syracuse University Sagamore Conference Center, Raquette Lake, New York. The participants analyzed the impact that the new roads will have on local communities and their potential beneficial or detrimental effects. Discussions revealed instances in which local areas have developed effective machinery for cooperative efforts between state highway officials, local officials and community planners, and other cases where no such cooperation exists.

The "Findings and Recommendations" emphasize the responsibility of local governments to formulate adequate community development plans and the responsibility of highway officials to consider these plans in the location and design of highways on a continuing basis.

The conferees urged state highway departments to establish urban staffs to develop tentative highway improvement programs for urban areas for a period of at least five years in advance, as a basis for planning at the local level.

It is agreed that the prime and legal responsibility to move the road program, rural and urban, belongs to the highway administrator, and that it is the responsibility of the local administrators, planners and engineers to do such planning on a city and regional basis as will ensure the maximum local benefits from the road program. If no plan exists at the local level, the state must take responsibility for initiating planning needed to advance the program.

Sewerage Improvements

In Alabama, 42 municipal sewerage improvement programs, costing roughly \$6.6 million, were either completed or started during 1958.



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CATCH BASIN AND SEWER CLEANING

HOWARD A. BIGGS.

Chief Sewer Engineer, Fort Wayne, Indiana,

T IS estimated that 90 percent of the expenses incurred in many cities in operating and maintaining a sewer system is the result of improperly designed or poorly installed sewers. Small wonder, then, that engineers should take a longer look at some of the elements which have brought about this unbalance between maintenance and construction costs.

When we start thinking of an economic sewer with a minimum of maintenance, we must start at the drafting board, first considering the flow characteristics and desirable capacities. Flow characteristics and velocities have an important part in the amount of maintenance that will be necessary to keep the sewer efficient.

One of the next things to consider is the type of soil in which the sewer will be installed. The type of bedding and the strength of pipe are important in making the life of the sewer as long as possible. The biggest problem, in many parts of the country where poor soil conditions exist, is pipe failure. In almost every case of pipe failure, the cause is improper design or construction methods. The selection of pipe joint material is vital. Poor joints allow the penetration of roots and their invasion into a sewer system presents a serious and expensive problem. In recent years there has been much progress made in improving sewer pipe joints and there is now a wide selection of patented joints and jointing materials available. Infiltration and exfiltration tests, which are rapidly becoming a part of many city specifications, have forced suppliers to make better and better

Another thing the designer should take into consideration is access to the sewer for frequent visual inspection, as well as for periodic cleaning and flushing. Spacing and location of manholes depends much on the type of equipment that will be used for cleaning the sewers and on the frequency of checking and cleaning. Places have been observed where a sewer was neglected so

long, and was so full of roots and debris, that it was cheaper to tear up and replace than try to clean. in other places, the sewer maintenance program has been so effective that manholes could be placed unusually far apart with little or no risk. In most cities, however, manholes on smaller sewers are placed 300 to 350 feet apart and this distance increases as the size of sewer increases. The placing of manholes should be determined by the sewer maintenance program and the type of equipment made available to the sewer maintenance depart-

The use of City standards based on proper design for catch basins, manholes, inlets, types of construction, joints, castings etc. has a very important part in keeping maintenance costs low. Sewer maintenance problems can be kept to a minimum with proper design and construction. Both are needed. The best sewer design is of no consequence, if construction is faulty. It is important that the sewer be constructed in accordance with the plans and specifications, using the best of materials and workmanship. Any first class sewer maintenance program must include close supervision and inspection of the project under construction. Poor joints, improper bedding, poor methods of backfilling the trench and irresponsible manpower are prime factors causing high maintenance costs. Poor inspection can ruin months of careful planning and design, while good inspection of the work under construction is insurance for a reasonably trouble-free sewer and will save many times its cost in maintenance-free operation.

Scheduled Maintenance

An actual maintenance program, to be a success, must be a scheduled one, rather than a hit and miss proposition, such as taking care of problems only as they arise. The scheduled program should include cleaning all sewers in a given area at a given time. Many cities clean all sewers twice a year, many once a year, some every two years and many have no program whatsoever. Accurate records should be kept of all problems and trouble spots, sewers cleaned and the date on which the work was accomplished,

etc. It doesn't take long to become familiar with the trouble spots and as soon as they are known, they should be checked at closer intervals.

Periodic flushing of troublesome sewers is desirable and often a good preventive of serious problems. However, flushing a sewer should consist of more than loosening the debris and forcing it into another section of the sewer. Many ingenious methods have been devised to make sewer flushing more effective, but sewer flushing is not entirely satisfactory unless the loosened debris is removed from the sewer before it becomes a massive accumulation.

It seems needless to call attention to the hazards involved in cleaning sewers. All precautions and safety measures should be used in entering any sewer or sewer facility. Minimum precaution should include thoroughly venting the sewer, no smoking and the use of masks. A safe and sound maintenance program prevents property damage, assures retention of sewer capacity. postpones expensive sewer replacement and promotes the general welfare and respect of the entire community. Every city will benefit immensely from a well-trained and adequately equipped sewer maintenance department.

Catch Basin Cleaning

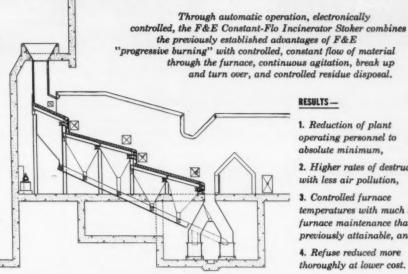
Catch basin cleaning also should be a scheduled program. Cleaning of catch basins can be classified into three main methods or combination of these methods. They involve dipping, orange peel buckets and eductors; each has its particular application. The basic things to consider are the effective cleaning of the catch basin; leaving the site of operation clean and free of hazards or unsanitary nuisances; and economy. The cleaning cycle depends on the volume of the basins, effective cleaning of the streets, use of street trash cans and the education of citizens in the use and purpose of catch basins, sewers and street gutters. It is not uncommon to find that people have stuffed leaves, grass clippings and other types of trash and debris into the catch basin. Correcting this is a public relations program coupled with the enforcement of sewer use regulations, educating the citizens to the values and uses of the sewer system and, at the same time, mitigating the problem of maintenance.

This is a condensation of a paper presented by Mr. Biggs at the 1958 Congress of the American Public Works Association.

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Prepared by CLAYTON H. BILLINGS, Associate Editor

Oxidation of Organic Cyanides

Increased use of organic cyanides (nitriles) for the manufacture of synthetic rubber, textiles, plastics and other products has enhanced the probability of nitrile contamination of surface water. Accordingly, an investigation was made of the behavior of six selected nitrile compounds in biological treatment systems. The compounds selected were acetonitrile, acylonitrile, benzonitrile, lactonitrile and oxydipropionitrile, and tests were made using Ohio River water obtained at the intake of the Cincinnati water plant. The oxidation system consisted of aeration with air stripped of carbon dioxide. The progress of oxidation was measured in terms of carbon dioxide produced. Observation of a system was continued until 60 percent of the theoretically possible amount of carbon dioxide was produced or until the oxidation curve approached a limit. At that point, half of the contents of the aeration unit was removed and analyzed for such information as concentration of nitrogen, pH, alkalinity, extractable components and biological population. The study compared several methods of determining the concentration of nitriles, since no chemical analysis technique has been found consistently reliable for these compounds. A modification of the method proposed by Varner, et al permitted high recoveries of all nitriles except lactonitrile.

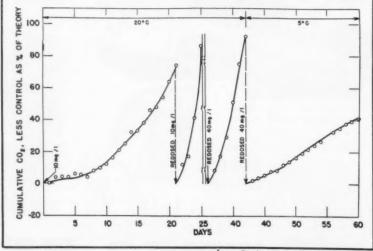
Both carbonaceous and nitrogenous oxidation cycles indicated acclimation of organisms to nitriles to a high degree, but the time required varied with the compound. Oxidipropionitrile was the most resistant. Acclimation occurred under wide variations in concentration and feeding interval. Organisms capable of assimilating lactonitrile and oxydipropionitrile readily used other tested nitriles, but the organisms varied in their response to the different compounds. The organisms adaptable to nitrile oxidation appear to be common in surface water, and while the laboratory tests required the use of nutrients that are available in sewage, it is not anticipated that availability of nutrients would be a problem in natural environments.

"Biochemical Oxidation of Some Commercially Important Organic Cyanides." By F. J. Ludzack, R. B. Schaffer, R. N. Bloomhuff, and M. B. Ettinger. Sewage and Industrial Wastes, January, 1959.

Chemical Plant Favors Incineration

The Dow Chemical Plant at Midland, Michigan, found that most of its waste was not recoverable as by-products and should be destroyed. Incineration, therefore, is to be provided for waste slurries

after combination with waste solvents, oils and tars; solid wastes after mixing with plant refuse; and dried sludge cake from liquid waste treatment processes. The liquid waste treatment works include sedimentation with trickling filter and activated sludge oxidation. The plant is capable of satisfying 80,000 pounds of oxygen demand per day. The effluent produced amounts to 65 mgd and has a BOD of 15 mg/L. However, it was discovered after the plant was built that biological treatment of the wastes does not solve the odor problem and that the optimum solution involves minimizing water contact with organic waste contaminants at the source and destroying resultant liquors by incineration. The existing rotarykiln incinerator can handle 50 tons of refuse per day, but with poor stack effluent. A new rotary-kiln refuse incinerator is under construction at present to handle all solid wastes and many slurries. Tars are separately collected. Tar



TYPICAL of the nitrile oxidation curves is that for acetonitrile, aerated in Ohio River water. After an initial lag, acclimation was rapid, even at higher feeds.



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storage, burning and scrubbing facilities were placed in operation last spring as an air pollution abatement measure. The liquid tars are hauled by Dempster - Dumpster tanks from about 50 production sources and are dumped into agitated holding tanks. The high-temperature, low-ash, and low-chlorine content tars can be mixed to produce a pumpable, high-Btu fuel oil. The remainder are handled in a stationary, 81-million Btu-per-hour furnace, equipped with a 50-foot stack and scrubbing system.

"Burning Industrial Waste Slurries." By Charles Sercu. Wastes Engineering, January, 1959.

Pulp Mill Reclaims Bark and Water

At the Rayonier Corp. pulp mill at Jessup, Ga., facilities were installed for removing bark and sand from processing water, thus making the water available for reuse. The bark is used as fuel in the plant boilers and sand and grit are used for fill. Water employed for conveying logs to the mill contains large quantities of fine bark, sand and grit. Two heavy-duty inclined screens are installed in channels receiving the spent water. The screens are of the continuously moving panel type with 1/2-inch openings. They retain the bark and permit the sand to pass through to sand collection channels. An inclined dewatering scraper conveyor transports the bark from the screen discharge point. Scraper collectors are used in the sand collection channels, which move the sand to a dewatering conveyor. Each screen handles 5 tons of bark per hour, and each sand conveyor, 9 tons per

"Pulp Mill Uses Screening and Desanding Units for Reclaiming Valuable Water and Bark." By S. L. Tolman. Wastes Engineering, January, 1959.

Radioisotopes in Flow Measurement

A procedure has been developed for measuring flow rates with a very high degree of accuracy using a radioactive tracer. Known as the total count method, it requires the addition of a definite quantity of radiotracer to the stream being measured and the subsequent detection of the tracer by a Geiger counter at a downstream point. The total number of counts recorded is inversely proportional to the flow rate, and the relationship can be formulated. The method is especially versatile in applying the divi-

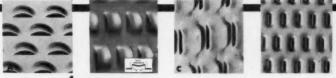
ded stream principle in measuring flow in open streams. The stream is considered as divided by imaginary partitions into a number of channels. While the counter is placed in only one of these channels and the flow rate may be faster or slower in this than the other channels, the total number of counts would be found to be the same in this channel as in the others and the proportion is definitely known. It can therefore be applied to gage a large stream by measuring a small part of it. Cesium-134 is suitable for use with the method in small streams because it emits gamma rays; is chemically stable in a water solution; and has a half-life of 2.3 years. In large streams the short-lived gold-198 is preferable for reasons of economy and safety. The method has the advantages of being inexpensive and accurate. While it can be used to check flow meters, it does not replace such meters because it is not readily adaptable to continuous flow measurement. With the use of an oil-soluble radioisotope, oil streams can be measured; similarly, radiokrypton can be employed for gas streams.

"Flow Measurement by Radiotracer." By D. E. Hull. M. Macomber, and J. H. Easthagen. Sewage and Industrial Wastes, January, 1959.

Traffic and Atmospheric Lead

The common use of gasoline containing tetraethyllead provides a plentiful source of atmospheric pollution by lead particulate matter. Lead is an accumulative poison, and research has indicated that particles in the range of 1 to 3 microns are retained completely in the lungs. Accordingly, a method for determining concentration and sizes of lead-containing particles was devised and supplements methods which give only the total mass of lead present. The study combines two established techniques, a sampling method using Millipore filters for retention of particles and an analytical method involving identification of lead by its reaction in an alcoholic solution of tetrahydroxyquinone. In the field testing method, an aerosol standard filter holder was clamped to the outside mirror support of a car and connected to the windshield wiper vacuum system. The filter membrane after reacting with the reagent was transferred to a glass slide, dried, made transparent with immersion oil and examined with a light microscope. Field tests were conducted under traffic conditions

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of stop-and-go, slow moving, and fast moving. Although the number of particles collected did not show a relationship consistent with the number of cars, probably because of greatly varying engine efficiencies, there was a consistency in the ratios of different particle size groups to the total number of particles reaching the sampler. Large numbers of particles were in the smallest range, from 0.1 to 2.7 microns. In stop-and-go traffic there is a greater percentage of larger particles. The study emphasized the importance of distinguishing size ranges.

"Determination of Particulate Lead Content in Air." By Barbara J. Tufts. Analytical Chemistry, February, 1959.

Where Fish and Chips Don't Mix

In 1957, nearly 12 percent of the national potato crop was processed into chips. The growth of the industry has created demands on water supply and has become associated with new waste disposal problems. A study was made of several potato chipping plants to obtain representative values of water use and waste strength. The study involved analysis of data

RACTOR

from a survey of waste discharge and correlation of the data with production figures and processing methods. The results indicated that for each 1000 lbs. of potatoes handled a waste volume of 1,990 gals. is produced; the BOD amounts to 25 lbs.; and the suspended solids, 33 lbs. Since the waste products vary with potato variety and method of processing, the dry solids lost in production provide a good basis for computation in the absence of sampling data. The dry solids balance is obtained from the solids content of the potato and the pounds of chips produced after allowing for the oil and moisture content of the chips. Each pound of dry potato solids exerts a BOD of 0.453 lb., which serves as a conversion factor for the solids lost.

Wastes originate primarily from the peeling, trimming, washing and rinsing operations. A counter-current principle of water use would seem to hold promise for reduction of water consumption and waste discharge. Disposal of the waste is best handled by discharge to a municipal sewer system. Other methods that might be considered are lagooning with land application or spray irrigation and trickling filters.

"Wastes from the Potato Chip

Industry." By Ralph Porges and W. W. Towne. Sewage and Industrial Wastes, January, 1959.

Other Articles

"Factors Affecting the Aeration Efficiency of Sewage and Industrial Wastes." By W. Wesley Eckenfelder, Jr. The performance of commercial aeration devices and effects of waste characteristics can be correlated in terms of an absorption number, which in turn can be used for aerator design. Sewage and Industrial Wastes, January, 1959.

"Railroad Waste Water and Maintenance Stations." By Robert A. Baum. The change from steam to diesel power has changed waste characteristics and has centralized maintenance operations, resulting in larger waste volumes and more complex problems. Industrial Wastes, January, 1959.

"Atomized Suspension Techniques, Part II," By K. L. Pinder and W. H. Gauvin. Breaking up solutions and slurries into droplets and subsequent heat drying offers promise in industrial waste by-product recovery. Industrial Wastes, January, 1959.

"Simultaneous Removal of Acid Gases Mists, and Fumes with Mineral Wool Filters." By C. E. Billings, Charles Kurker, Jr., and Leslie Silverman. An overall evaluation of mineral wool filters, as to filter composition, size and fiber diameter when used for removing corrosive air contaminants. Journal of the Air Pollution Control Association, November, 1958.

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PIPE was fabricated with the lower half of joint connecting bands attached.

Big Pipe Solves Storm Drainage Problem

A DEQUATE drainage has long been a problem along US #131, south of Kalamazoo, Mich. After periods of heavy rainfall low areas of the road flooded and water backed up onto adjacent property. As these areas developed, the problem became acute. More roof tops, more paved streets and many paved parking lots increased the amount of runoff to the point where a large drainage system had to be built.

The South Westnedge project was designed to correct this problem. It involved 2926 ft. of 72-inch; 1479 ft. of 66-inch; 677 ft. of 54-inch; and 1187 ft. of 42-inch diameter pipe. All of the 72-inch, most of the 66-inch and some of the 42-inch diameter pipe is Armco Smooth-Flo sewer pipe. Total cost was slightly over \$415,000.

Use of a special connecting band on the pipe speeded the installation, with up to 250 feet being laid in one day. The bottom half of the band was riveted to the pipe at the time of fabrication. Then, when the next section of pipe was placed, the top half of the band was placed and quickly bolted.

Use of these bands offered another advantage. The water table was generally above the flow line of the pipe which meant that well-pointing and some sumping was necessary. Even so, some of the pipe was laid in water. This did not cause undue trouble because of the method of jointing. Average depth of the 72-inch pipe is 12 feet; of the 66-inch pipe, 15 feet; and of the 42-inch pipe, 10 feet.

Since completion of the project the area has not flooded during the heaviest rainfall. Nor has the removal of the runoff to Portage Creek created any flooding there.

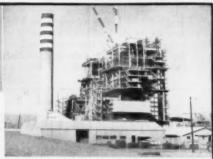
Charles E. Ashley, Kalamazoo County Drain Commissioner, was in general charge of the project. C&M Dredging of Elkhart, Indiana, was the contractor for both sections of the project. William H. Wilkins of Kalamazoo was consulting engineer and Robert E. Snell was project engineer. Warren L. Arnold acted as superintendent for the contractor.

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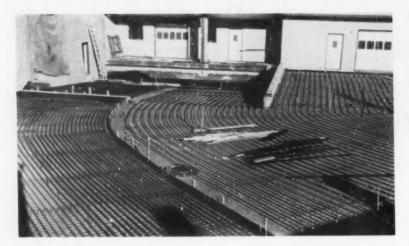
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SNOW MELTING SYSTEM

Installed at State Highway Building



SERVICE CARS and trucks of the Minnesota Highway Department have easier wintertime access to and from the new \$8 million State Highway Building because of an automatic snow melting system.

This view shows 4-D wrought iron pipe coils before they were embedded in 6 inches of concrete. The system is designed to assure dry pavement even in the worst weather for vehicles moving in and out of this loading dock area.

An ethylene-glycol solution circulates through this ¾-inch diameter pipe, produced by A. M. Byers Company, Pittsburgh. The system covers a 16,000-square-foot area. Designed by Ellerbe & Company, St. Paul, it was installed by Rueben L. Anderson & Cherne, Inc., Minneapolis.

4-D wrought iron pipe's ability to resist corrosion also led to its use in the building's soil, vent and waste lines, and down-spouts.

In order to build a sound long range safety program the state is using the services of Thomas F. Lively, of Lively-Blair and Associates, Minneapolis, Minn., a consulting safety engineering firm.

> Drainage of a Chicago Superhighway

The drainage system of those portions of the Northwest Route Superhighway in Chicago, which are depressed below the existing street level is being designed to accommodate storm water runoff for storms of fifty-year frequency. Elevated sections of the superhighway are being designed for ten-year storms and are to be drained into the present City sewer system at selected locations so as not to overload that system.

The 10 acres of the Northwest Route between the Halsted Street Interchange and Monroe Street are to be drained southward into the main drain of the Congress Expressway thence to the existing pumping station located at Desplaines and Van Buren Streets.

The 60 acres of the Northwest Route lying between Monroe Street and Augusta Boulevard, including the Ohio-Ontario Interchange, are to be drained into a pumping station that will be located at Fulton Street and Union Avenue. The portion of the main drain from Fulton Street to Hubbard Street is presently being built in tunnel. The remainder of the main drain for this section of highway will be built by open cut construction methods along with the grading and paving contracts.

The Fulton Street Pumping Station will have five 10,000-gpm storm pumping units which will lift the storm water runoff into a sewer now being constructed in Fulton Street and thence into the Chicago River. From just north of Augusta Boulevard to Henderson Street, the Superhighway is to be built on embankment and the drainage for this section is to be constructed as a part of the grading and paving contracts.

The drainage of 240 acres of the Northwest Route between Henderson Street and the city limits at Canfield Avenue and Higgins Road will be handled by a pumping station to be located at Henderson Street and Central Park Avenue. The Henderson Street Pumping Station will have six 12,000-gpm pumping units. The main drain for this section is being built in five separate sections, four by tunnel methods and one by the open cut method.

CONSTRUCTION SAFETY PROGRAM

HORACE J. GUNN,

Information Officer, State Road Commission of Utah

A move to lessen accidents at state road construction sites and thus reduce construction costs is now underway by the Utah State Road Commission. The coordinator, a veteran of safety work in the state, is Keith M. Macfarlane.

One of the first moves of the new Safety Coordinator was to prepare an accident prevention clause to be inserted into construction contracts, commencing in the state November 1, 1958. It is believed that Utah is among the early states to add such a provision to their contract specifications. State officials are of the opinion that this action will aid in protecting the traveling public as

well as the employees of the contractor, and also highway crews.

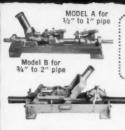
In the special provisions being added to construction agreements, it is intended that the "Manual of Accident Prevention" published by the Associated General Contractors will be closely complied with. Details of the manual are being reviewed with all state engineers. In addition, State Road authorities will be working closely with the officers of the Associated General Contractors of Utah in carrying out the new provisions.

The new program for Utah has been worked out through the cooperation of a safety committee comprising the Director of Highways, certain staff engineers of the Road Department, and the State Industrial Commission.

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FIELD TESTING OF ELECTRICAL EQUIPMENT

BRUCE J. ENNIS,

Principal Engineer,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

ENERALLY SPEAKING, in the design of an expansion or addition to generating stations, water plants, pump stations, sewage plants, and similar projects, the specifications for the type and quality of electrical material and equipment are quite thorough, and spell out in detail the necessary requirements for wire, cable, conduit, switchgear, control devices, and other equipment. In most cases, specifications also describe comprehensively the method required for the installation of equipment and the manner in which duct systems are to be constructed and wire and cable are to be installed. In many cases, specifications stop at this point on the assumption that the contractor has all the information necessary to purchase equipment, bolt it into place, connect it up with power and control circuits, and turn it over to the owner, ready for operation.

In order to assure that the electrical equipment has been properly installed and connected and that it is, in fact, ready to be turned over to the owner for operation, electrical installation specifications should include a section devoted entirely to the very important functions associated with field testing of the equipment.

It is not enough to assume that metalclad switchgear, relays, meters, instruments, and control panel devices will arrive from their manufacturer in perfect condition, ready to go into service. Transportation jolts can throw delicate apparatus out of balance, and can lead to subsequent malfunctioning of switchgear breaker linkages, latch-in contactors, auxiliary switches, relays and similar equipment.

Neither is it enough to assume that even the most efficient and conscientious cable splicer will wipe every pothead and fabricate every stress cone on high voltage cable with complete freedom from internal voids, moisture, and sneak grounds to the extent that the cable system

may be energized without faults developing either immediately, or, more disastrously, at some future date, after the plant is in full commercial service.

If the electrical installation specifications require a thorough program of field testing of all equipment and material, following installation but prior to initial energization, it is often possible to eliminate all, or nearly all of the incipient faults that might develop into plant outages from subsequent failure of electrical gear and circuits.

The amount of detail which should be covered in the field testing section of electrical installation specifications will depend to some extent on the size and scope of the construction project, the degree of complexity of the protective and control apparatus, the operating voltage of the power cable circuits, motors, and associated devices and related matters. In general, however, such specifications should include the following requirements:

 All testing to be done by fully qualified and experienced personnel of the contractor who shall exercise the utmost care to provide safe testing apparatus and procedures.

Complete records of all test data to be furnished to the owner at the completion of the tests. Tests to be witnessed by the owner and the engineer.

 High potential d-c testing of high voltage cable.

 High potential a-c testing of all switchgear circuit breakers, insulating oil, and askarel.

5) Megger testing of all low voltage wire and cable, transformers, motors, generators, motor starters, contactors, panelboards and similar devices. Substandard insulation resistance on motors, generators, and transformers to be corrected by drying-out procedures prior to initial energization.

 Phasing checks and synchronizing tests to be made wherever a load can be supplied by two

TABLE 1-TYPICAL TEST CRITERIA

| High Potential Test | Min. | Test | Voltage |
|---|------|------|---------|
| Insulating Oil Dielectric Test (Transformer and Oil Circuit | | | |
| Breaker Coolant) | 22.5 | kv, | а-с |
| Insulating Askarel Dielectric Test (Transf. Coolant) | 30 | kv, | a-c |
| 15 ky Metalclad Switchgear Breakers | 37.5 | kv, | a-c* |
| 15 kv Metalclad Switchgear Breakers | 53 | kv, | d-c |
| 5 kv Metalclad Switchgear Breakers | 14 | kv, | a-c* |
| 5 kv Metalclad Switchgear Breakers | 20 | kv, | d-c |
| 600 volt Breaker—(if desired) (not molded case) | 1.65 | kv, | a-c* |
| 600 volt Breaker—(if desired) (not molded case) | 2.32 | kv, | d-c |
| 15 kv Ungrounded Neutral Service Cable (1000 mcm and | | | |
| smaller, 27/64" Insulation) | 90 | kv, | d-c |
| 15 kv Grounded Neutral Service Cable (1000 mcm and | | | |
| smaller, 19/64" Insulation) | 63.6 | kv, | d-c |
| 5 kv Ungrounded Neutral Service Cable (8-4/0, | | | |
| 10/64" Insulation) | 33.6 | kv, | d-c |
| 5 kv Ungrounded Neutral Service Cable (225-1000, | | | |
| 11/64" Insulation) | 37.2 | kv. | d-c |
| 5 kv Ungrounded Neutral Service Cable (Over 1000 | | | |
| mcm, 12/64" Insulation) | 40.8 | kv, | d-c |
| *Preferred | | | |

Wire and cable must be disconnected from terminal apparatus during high potential tests.

| Insulation Resistance | Minimum Desired Insulation |
|--------------------------------------|----------------------------|
| Megger Tests | Resistance in Megohms |
| 440 Volt Motors (100 hp and smaller) | 0.44 (at 80 C) |
| 2,300 Volt Motors (200 hp) | 2.3 (at 80 C) |
| 2,300 Volt Motors (500 hp) | 2.2 (at 80 C) |
| A-c Generator Stator (20 mva) | 65 (at 40 C) |
| A-c Generator Stator (40 mva) | 45 (at 40 C) |
| A-c Generator Stator (40 mva) | 140 (at 10 C) |
| A-c Generator Stator (40 mva) | 14 (at 70 C) |

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sources to prevent changing rotation of motors or paralleling sources out of phase.

7) Proper testing, setting and adjustment of all relays with test apparatus under simulated fault conditions.

8) Adjustment and testing of all circuit breakers, relays, meters, switchgear, control switches, contactors, motor starters, auxiliary switches, disconnect switches, fuses, indicating lights, annunciators and all other electrical apparatus and equipment to assure proper operation and mechanical and electrical functioning. For work of a special nature, the specifications should require the services of a field representative of the manufacturer of the equipment to direct the contractor's employees in the proper adjustment, setting and testing of such equipment and to instruct the owner's operators in the care, operation and maintenance of the equipment.

1

4

9) Tests to be made of station ground system to assure low resistance protective grounding of generator and motor frames, switchgear housings, conduit system and other devices, and low resistance electrical grounds for lightning arresters, transformer neutrals, etc.

The specifications for field testing should include specific requirements for the various phases of the testing, to serve as a guide both for the contractor's employees as well as for the field engineering inspector. They should be completely self-contained, with limits of acceptable test criteria spelled out in detail so that reference need not be made to cable. switchgear and equipment standard publications not normally available in a construction field office.

For example, in a power plant project containing customary switchgear and equipment and synthetic rubber insulated wire and cable, the field testing specifications might include typical test criteria, as shown in Table 1.

Insulation resistance in megohms varies greatly with the temperature. Megger readings with cold windings will be greater than readings with hot windings. In the case of the 40,-000-kva generator stator winding listed in Table 1, readings at 10 C will be approximately ten times the readings at 70 C, based on Class B insulation.

There are no standard limits for acceptable insulation resistance of transformer windings. Prior to initial

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41 East 42nd St. Montgomery Bldg. New York 17, N.Y. Spartanburg, S.C. energization however, tests should be made of the dielectric strength of insulating liquid, and, as a general guide, windings should be dried out if the 25 C megger readings are lower than 500 megohms for 13.8 kv liquid filled transformers, 100 megohms for 2.4 kv liquid filled transformers, 750 megohms for 13.8 kv dry type transformers and 125 megohms for 2.4 ky dry type transform-

In no case, should generators, transformers, or large motors be energized prior to drying out their windings to obtain acceptable values of insulation resistance as determined by the manufacturer for the specific item of equipment being tested.

Megger tests of 600-volt wire and cable should be tested to assure insulation resistance conforming with the requirements of Article 1120 of the 1956 National Electrical Code, which range from one megohm for No. 12 wire to 5,000 ohms for conductors larger than 500 mcm at room temperature of 86 F (30 C).

There are no hard and fast rules as to the size or type of an electrical installation project which will warrant a comprehensive program of field testing. For example, : 15-kv cable supplying power to a large water pumping station could be as important as a similar cable supplying the auxiliary motor load in a power plant. Failure of either cable could lead to serious outages, depending on the availability or lack of standby power sources. The decision regarding the high potential testing of such cables to assure reliable performance is a matter of judgment involving the size, design, and importance of the project, weighed against the additional expense of the field testing program.

TECHNICAL MEETINGS

Roadside Development **Short Course**

The 18th Annual Short Course on Roadside Development will be held in Columbus, O., October 6-9. For more information, write W. S. Garmhausen, Chief Landscape Architect, Department of Highways, Columbus 15, Ohio.

Purdue Industrial Waste Conference Announced

The 14th conference on industrial waste problems sponsored by Purdue University will be held at the University Memorial Union Building in Lafayette, Indiana. May 5 through 7. Approximately fifty papers are scheduled on the program which will be released in April. Information regarding registration details and the program may be obtained from Professor Don E. Bloodgood, Purdue University, Lafayette, Indiana.

Symposium on Industrial Uses of Radioisotopes

A symposium on the industrial uses of isotopes will be held on the campus of Georgia Institute of Technology May 11 and 12. Joint sponsors are Georgia Tech., the AEC office of Isotopes Development and Lockheed Aircraft Corp. For full information write Richard Wiegand, Director, Short Courses & Conferences at Georgia Tech., Atlanta, Ga.

Illinois Water Works Safety Conference

A water works safety conference was held at the University of Illinois, Urbana, Ill., Jan. 28 and 29. This is the first of a planned series of annual sanitary engineering conferences to be held under the general leadership of Ben B. Ewing, Associate Professor of Sanitary Engineering.

Middle States Public **Health Association**

The tenth annual meeting of the Middle States Public Health Ass'n will be held at Des Moines, Iowa, April 1-3. More information from Thelma Luther, State Dep't of Health, Des Moines 19, Ia.

International Course in Hydraulic Engineering

The third session of the International Course in Hydraulic Engineering will be held at Delft,, the Netherlands, beginning on October 21, 1959. It will last 11 months, with four one-week intervals for holidays. Medium of instruction is English.

Since each individual participant will have a special interest in those subjects which he is likely to encounter in his later career, arrangements have been made to enable each participant to adapt the program to his personal requirements. There are three alternative branches of study (1) Tidal and coastal engineering (including harbors); (2) rivers and navigation works (including ground-water recovery); and (3) reclamation.

Apply to the Netherlands Universities Foundation for International Co-operation, 27 Molentraat, the Hague, the Netherlands.

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Sealing Iron for Plastic Water Stops

For making water tight joints, tees, crosses and corners in plastic water stops, Water Seals, Inc., offers a heat sealing iron which welds vinyl plastic material. The iron is plugged into a rheostat using 110-volt AC current, and heat is applied simultaneously to the surfaces to be joined. The use of a jib is recommended to permit alining of corrugations and ribs, important in making water tight joints. The standard iron is portable, 10 inches wide, 4 ins. high and 3/8 in. thick, permitting its use inside forms. It is available as a kit and contains equipment for cleaning the iron. Further information from Water Seals, Inc., 9 South Clinton St., Chicago 6, Illinois, or circle No. 3-2 on the reply card.



Standard iron is portable, ten inches wide and four inches high, permitting its use inside of construction forms



Backhoe has digging depth of 18' 10"

Schield Bantam Introduces Three All-New Models

Schield Bantam has announced the introduction of its completely redesigned line of carrier-mounted, crawler-mounted and self-propelled 3/8-yard crane-excavators. Bantam's wide work range and versatility has been further broadened through greatly increased lifting capacities (11 tons on the Model T-350 carriermounted unit, 11 tons on the selfpropelled CR-350 and up to 8 tons on the crawler-mounted C-350 Bantam); and by greater flexibility in its complete attachment line. The new "350" Bantam basic unit has been completely redesigned to give greater strength and longer troublefree life. Continental F-209 gasoline engines are used as standard power units adding approximately 14 percent more horsepower to the new models. Diesel and electric power units are offered as options. For more details write Schield Bantam Co., Waverly, Iowa, or circle No. 3-3 on the reply card.

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Cat Motor Grader Rated at 150 HP

The Cat No. 14 motor grader, rated at 150 hp and weighing more than 29,000 pounds, has joined the Caterpillar product line as the largest, most powerful motor grader ever to be made by the company. Of the total weight, 22,000 lbs. rest on the drive wheels where it can be used, giving the unit the traction fully to utilize its large size and power. Power is provided by a turbocharged engine rated at 150 hp, which has an 18 percent torque rise. The transmission provides six forward and two reverse speeds. Forward travel speeds range from 2.6 mph in first gear, to 21.6 mph in sixth. The 12-ft. blade with its higher moldboard and 5-in. clearance between blade-top and circle drawbar, gives the ability to carry large amounts of material on the blade without interference with its flow. Power assisted brakes are incorporated, reducing the operator effort required to control the machine and power steering has been



Increased travel speeds and high lugging ability are features of the Caterpillar No. 14 grader, powered by a turbocharged, 150 hp diesel. Engine design provides an 18% torque rise, which allows unit to respond quickly

made standard. Fine blading control is especially provided for by a new, faster, fully-transistorized Preco blade control. In addition to the increased response-speed of this control unit, the transistorized circuits make it more durable and capable of withstanding extreme applications. For more details write Caterpillar News Service, Peoria, Ill., or circle No. 3-5 on the reply card.

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All-aluminum rest station provides savings in maintenance

Versatile Tractor-Digger



Ford-Sherman team is a fast and efficient excavating unit

Providing savings in weight and upkeep, this unique unit can be used at parks, and for parades and other large gatherings. With its own 550-gallon water supply and sewage system, this comfort station can be placed in any location and will operate for a full day, accommodating 600 individuals. It can also be hooked up with local sewer and water systems if desired. It weighs only 12,000 pounds. It is lighted by connections with local power lines

or a portable generator can be installed for use where power is not available. Fluorescent lights and high windows illuminate the interior and a utility compartment in the center separates the men's and women's sections. The mobile station measures 36 ft. long, 8 ft. wide, and 8¾ ft. high. Overall height from the ground is 10½ ft. More details from the Fred S. Gichner Iron Works, Washington, D. C., or circle No. 3-7 on the reply card.

Portable Electric Plant

A new lightweight 2500-watt electric generating plant has been specifically designed for a dual role, portable and/or emergency standby, according to an announcement by Onan. Weighing only 140 pounds, this gasoline engine-driven generator set is equally at home as a heavy-duty power plant on a construction site or as a dependable source of standby power. Completely self-contained, the versatile unit will provide full-rated AC power to run electric tools, lights and motors for contractors. Both Model 205AJ-1P/1430 (contractor model) and Model 205AJ-1M/1430 (standby model) are identical in weight and size with the exception that the contractor unit is equipped with an aluminum carrying frame. Each of these is equipped with a separate 5-gallon fuel tank. For further data write D. W. Onan & Sons Inc., 2515 University Ave., S. E., Minneapolis 14, Minn., or circle No. 3-6 on the reply card.



Portable electric generating plant is equipped with aluminum carrying frame



Tool is installed quickly and easily on all current models of Ford tractors

Versatile Machine For Maintenance Work

The Lev-L-All, a maintaining tool has been introduced by White Star Enterprises. Designed as a low-cost unit for contractors, municipalities and governmental units concerned with grading, levelling, ditching and maintenance, the Lev-L-All provides an extra degree of performance which utilizes the full power of the Ford tractor. It is installed quickly and easily on all current models of Ford 600, 800 and 1800 series tractors. The Lev-L-All's ease of operation is basically due to its built-in stability, effortless steering, a minimum turning radius, convenient hydraulic controls, a fully visible blade and the ideal distribution of weight which provides traction for the use of full engine horsepower in all gears. Full information from White Star Enterprises, Inc., P. O. Box 1052, Wichita 1, Kansas, or circle No. 3-8 on the reply card.

The proven, field tested Sherman F-8 "Panther" Power Digger, Model 1128, is now available for mounting on Models 1821 and 1841 of the Ford Industrial Tractor just introduced. A feature of the new tractor-digger combination is the use of an independent electric fan-cooled heat exchanger that serves the Industrial-Universal and Sherman Digger hydraulic system. The end result of this simple installation is to neutralize such detrimental factors as extremely hard digging, high atmospheric temperatures and sun heat radiation. This new Ford-Sherman team is a rugged, fast and efficient excavating unit that will provide sustained digging action under difficult conditions of application. The heat exchanger is equipped with 6-volt motor, with a resistor added to the electrical system when the digger is installed on a tractor with a 12-volt circuit. For more data write Sherman Products, Inc., Royal Oak, Mich., or circle No. 3-9.

Centrifugally Spun
Concrete Lighting Standards

Spunco Products has available centrifugally spun concrete lighting standards, transmission poles, sewer and pressure pipes, piling and columns. Lighting standards are available in standard and custom design to fit any architectural style. Poles are fabricated with holes, slots and openings to specification. Transmission poles are fabricated in lengths up to 105 feet. Tests reveal centrifugally spun concrete poles have great strength plus extreme flexibility. Spunco centrifugally spun concrete sewer, drain and pressure pipe are fabricated in diameters up to 8 feet, in lengths up to 22 feet. The conical and cylindrical piling are fabricated with attached conical hard steel caps which are an integral part of the pile. For more information write Spunco Products, Inc., 4623 Chippewa St., St. Louis, Mo., or circle No. 3-10 on the reply card.

Transistorized Flashing Light

A new 7-in. transistorized flashing light for large construction and runway jobs has been developed by Traffic Equipment Co. The specially designed high impact plastic lens and the longer, slower flash (50 to 60 per minute) gives better warning to motorists approaching at higher speeds. The lens design has an exclusive reflector ring at the outside which produces added brilliance when car lights strike the lens. Incandescent bulbs on all Sentry flashing lights provide a more brilliant penetrating flash. The entire unit is waterproof and vaporproof and will operate continuously off its six-volt battery for 2200 hours. The built-in switch is tamperproof. Full details available from Traffic Equipment Co., 2064 South Bannock St., Denver 23, Colo., or circle No. 3-11 on the reply card.

Heavy-Duty Outdoor Luminaire

Holophane announces No. 440, a heavy-duty outdoor luminaire. The light controlling element is a onepiece prismatic refractor made of



Outdoor luminaire for street lighting

thermal shock-resisting glass, designed for use with 400-watt mercury vapor or 500-watt incandescent lamps. Over-all dimensions are 161/2in. diameter and 151/2-in. depth. A holding device supports the glass member by means of a stainless steel spring hinge; pressure latches securely hold the refractor assembly against the gasketed hood, keeping the interior of the unit weather tight and free of dirt. The luminaire can be installed on cast aluminum brackets or on a standard pole bracket arm. For further details write Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y., or circle No. 3-12 on the reply card.

Mower Cuts, Shreds Brush and Weeds

The Terrain King, made by Specialty Mfg. Co., makes a full 15-ft. cut and mows from 80 to 120 acres per day. Using one tractor operated by one man, the cutter can do the work of three or more conventional mowers. The extreme flexibility ab-



Mower makes a full 15-foot swath and can mow from 80 to 120 acres per day

sorbs shock loads, minimizes breakage and adjusts to the contour of the land. It also can be adjusted easily to cutting heights of from 2 to 12 ins. A built-in winch and cable quickly hoists outer-mower sections for easy transportation and passage through narrow places. As a rule of thumb, the machine will cut down anything it will bend over when powered by a 30-hp tractor. For complete details write Specialty Mfg. Co., Inc., P. O. Box 7616, Houston 7, Tex., or circle No. 3-13.

Laboratory Kneading Compactor

A new electro-hydraulic compactor developed by Soiltest, features a true kneading action and offers wide flexibility in preparation of test specimens in materials testing and research laboratories. The Model CN-425A Kneading Compactor can be used to prepare and compact samples of bituminous mixes, asphaltic concrete, soils and similar materials. Three new elements of flexibility have been introduced in this apparatus: Adjustable compaction foot pressures, adjustable time of dwell on the specimen and a variable rate of compaction. Other features include an automatically indexing mold table, a predetermined cut-off counter, a pressure dwell timer which can be set to a variety of dwell periods, both automatic and manual operation and adjustable air pressure regulators. Data from Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill., or circle No. 3-14.

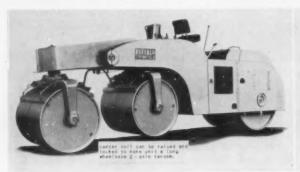
Allis-Chalmers One Forty Five Motor Grader

Allis-Chalmers has expanded its construction machinery line with the addition of the Model "One Forty Five" motor grader, an 80-hp, 21,540-lb. unit. The tandem drive machine is powered by an Allis-Chalmers four-cylinder Diesel engine that develops 80 hp at 1800 rpm. It has six forward speeds ranging up to 20.3 mph, and three reverse speeds up to 7 mph. Pointing-up big grader performance is the 90° maximum bank cutting capability of its 12-ft. moldboard for back sloping highway cuts and ditch construction; a wide shoulder reach outside the front wheels which gives an advantage for such work as grading soft highway shoulders; and its power actuated, fully reversible circle turn. Power operated leaning front wheels and 6,500 lbs. of weight on the front axle give the grader extra resistance to side thrust of big moldboard loads and provides frontend stability required for extra duty performance and for easy steering and grader maneuverability. Quickaction, positive mechanical controls are located within easy reach. The foot operated accelerator-decelerator pedal controls engine speed without the need for the operator to remove his hands from work controls to change throttle setting. Special equipment that adapts the grader to a wide range of special conditions includes power hydraulic steering, hydraulic shiftable moldboard, heavy-duty scarifier and "V" type snow plow and wing. For more details write Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc., or circle No. 3-15.



PUBLIC WORKS for March, 1959

Buffalo-Springfield Adds Hydraulic Lifting Cylinder to "Walking Beam"





Hydraulic lifting cylinder makes the Buffalo-Springfield tandem roller convertible to 13-20 ton, 2-axle tandem machine

Additional versatility, both in operation and in job applications, is now possible with the Buffalo-Springfield KX-25E, 3-axle "Walking Beam" tandem roller. With the hydraulic lifting cylinder, it is no longer necessary to depend on the terrain to position the Walking Beam (carrying the end guide roll)

in the desired locking position. The operator can now raise or lower the beam at will. The roller, with the center roll raised, can be used as a 13-20 ton, 2-axle tandem. Long wheelbase arrangement offers the conventional 2-axle tandem weight distribution of one-third of the total weight on the steering roll and two-

thirds on the drive roll. Hydraulic lifting cylinder kits are available to permit the attachment of this new feature to machines that are now in the field. Complete information specification can be obtained from Buffalo-Springfield Roller Co., Springfield, O., or circle No. 3-18 on the reply card.

New Corrosion Resistant Shut-Off Gates Announced

New, dustite, self-cleaning double rack and pinion shut-off gates that are said to provide trouble-free operation with certain ash, chemicals, sewage, sand and gravel, have recently been developed by Beaumont Birch. An outstanding feature is the design of the gate plate which is renewable with material in the field without replacing racks. Standard features for the 12, 14, 16, 18, 20, 24, and 30-in. gates include: Deep U-section gate plate assembly; open tooth corrosion resistant aluminum alloy racks; self-cleaning cast iron pinions located above racks; lapped seal on all four sides of gate plate; cast aluminum gasketed access doors; 3/8-in. steel plate body with 34-in, thick flanges; external grease fittings for all rollers and bearings; relief chamber for displaced material when closing through standing column; and hand-



Dustite, self-cleaning shut-off gates

wheel, chainwheel, ratchet, cylinder or motor operation. For full details write Beaumont Birch Co., 1505 Race St., Philadelphia 2, Pa., or circle No. 3-16 on the reply card.

Parking Meter Offers Lower Maintenance and Operating Costs

A new manual parking meter, the Rockwell M-1, engineered for lower maintenance and operating costs has been introduced by the Dual Parking Meter Co. Maintenance problems are greatly reduced by the use of a new permanent adjustment coin handling mechanism which is entirely riveted. There are no screws, bolts or nuts to come loose. This permanent adjustment eliminates the necessity of adjusting the meter every time minor maintenance is performed. Because of gravity-drop coin insertion method it is impossible to get at the timing mechanism. There can be no loss of register time or danger to the integral parts of the meter through tampering. The new meter will take pennies, nickels, dimes, quarters and tokens through a single slot preventing the motorist from putting a coin in the wrong slot and losing both time and coin. A pickup pawl measures the coin diameter and engages the flag at the proper time. For further data write the Dual Parking Meter Co., 400 N. Lexington Ave., Pittsburgh 8, Pa., or circle No. 3-17 on the reply card.

Low-Bed Trailer

International Harvester has just introduced a new 13,000-pound rated capacity six-wheel low-bed trailer with independent rubber mounted wheel suspension for heavy-duty hauling. The trailer is equipped with rubber-mounted torsion axles which act as a combination spring and shock absorber and work equally well whether the vehicle is loaded or empty. Independent oscillation of each wheel enables smooth movement of the trailer when pulled over rough terrain or at normal highway speeds. Harvester's all-steel, singleunit welded angle steel frame gives stability and balance to the entire trailer bed. A ramp for fast one-man loading and unloading operations also serves as a tailgate. Over-all width is 8 feet, over-all length is 21 feet and the basic machine weighs 1,900 lbs. For more details write the Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle No. 3-19 on the reply card.



PUBLIC WORKS for March, 1959

Repair Roadway Surface Any Time in Any Weather

A new all-weather outdoor patching material for chuck-holes, cracks and ruts in black-top, concrete, brick and stone has been developed by The Monroe Co. ZOR-X can be applied in the winter months, quickly and economically, even if the surface is wet or the temperature as low as 15°F. It sets immediately. There are two grades-one for depressions less than 2 ins. deep and one for holes more than 2 ins. deep. The depression or crack has only to be filled with ZOR-X, then tamped. The material comes ready to use-nothing to add or mix. It can be stored for months and does not harden in the drum. For further information write The Monroe Co., Inc., 10707 Quebec Ave., Cleveland 6, Ohio, or circle No. 3-20 on the reply card.

Vibratory Compactor Attachment for Payloader Units

Frank G. Hough Co. has announced a vibratory compactor attachment designed exclusively for all four - wheel-drive Payloader tractor-shovel models. This selfcontained and self-powered attachment uses the Jackson electric system and can be interchanged with the bucket in a matter of minutes. A heavy-duty, air-cooled motor and generator unit drives electric-motor vibratory units on four compactor pads. Each of the pads delivers up to 4,200 three-ton blows per minute. The unit is recommended for granular soil sub-bases and the base courses of sand, gravel, rock or slag in waterbound and penetration macadam construction. The total compacting width of the unit is ten feet. Any of the four shoes can be quickly detached from the mounting and used as a manually-guided, self-propelled unit to compact hardto-reach areas. The regular hydraulic boom control raises and lowers the attachment. All operating compactor controls are handled from the driver's seat to facilitate ease of operation. Complete information from the Frank G. Hough Co., 761 Seventh Ave., Libertyville, Ill., or circle No. 3-21 on the reply card.



Compacting width of unit is ten feet



Waterstops may be quickly and easily spliced on the job by applying heat

Meadows Announces Improved Waterstop

W. R. Meadows now introduces a modern, improved waterstop-the Sealtight Hydrojoint. This is extruded from a special compound of Polyvinylchloride to which has been added plasticizers and stabilizers to provide all of the qualifications necessary for the effective performance of a waterstop. They are engineered with a unique cross-section featuring improved-design multi-ribs to provide a tenacious holding power. The center bulb has been designed to provide the ability successfully to handle tremendous pressures caused by concrete movements. The waterstops are chemically resistant to chlorinated water, salt water, acids, alkalis and sewage wastes. They are strong, lightweight and easy to handle; and are supplied in 50-ft. coils. For further details write W. R. Meadows, Inc., Elgin, Ill., or circle No. 3-22 on the reply card.

Fluorescent Lamp Permits Higher Light Levels

Increase in light output is achieved by redesign of GE's Power-Groove lamp. The new design involves grooves along opposite sides of the tube, rather than along one side only. Weight of the lamp is reduced by nearly one quarter, making it easier to handle. In existing Power-Groove fixtures the improved lamps will start and operate reliably, in most cases with increased light output. In new installations, with ballasts and fixtures of designs keyed to the improved lamp, the full 15 percent gain in light output will be achieved. The new design uses 40 three-inch crescent-shaped grooves alternately on opposite sides of the 96-inch tube. In an 8-foot-long tube of new design, the arc stream is forced by the grooves to travel an extra foot, or a distance equal to the arc in a nine-foot lamp. The new lamp produces 15,000 lumens at 215 watts, or an efficiency of 70 lumens per watt. For more details write Press Relations, General Electric. Nela Park. Cleveland 12. Ohio. or circle No. 3-23 on the reply card.

Carter Double Diaphragm Pump

Carter's latest 4-in. double-diaphragm pump is an addition to the Humdinger pump line, providing more capacity with greater solidshandling ability than any previous unit of its type. Features are: oversized, heavy-duty ball valves; spring-cushioned diaphragm plunger rods to eliminate shock and protect bearings; easily replaceable valve seats; a suction air chamber to reduce suction pulsation and prolong hose life; and a discharge air snifter valve that minimizes discharge surge and hose chafing, resulting in smooth shock-free pump operation even under high lift conditions. The unit is available with Wisconsin or Briggs-Stratton engine. as well as electric motor drives and is offered in a choice of five different mountings. More detailed information from Ralph B. Carter Co., 192 Atlantic St., Hackensack, N. J., or circle No. 3-24 on the reply

Cast Iron Pipe That Bends and Twists



Eight-inch pipe shown bent in tests

American Cast Iron Pipe Co. has announced the introduction of a complete line of pipe, tubing, casing, fittings and special castings made from American Ductile iron. A major application is for water service mains where high pressures, extreme beam and crushing loads, unusual shocks and stresses, unstable bedding and deep fills may be encountered; under such adverse conditions, the pipe will twist and bend without breaking. Its tested and proven corrosion resistance assures maximum service life without the added expense and inconvenience of special coatings and wrappings. The pipe provides ample wall thickness for direct taps into the pipe wall without saddles or welding. A wide variety of joints are available which can be quickly and easily assembled and are bottletight. For complete data write American Cast Iron Pipe Co., Box 2603, Birmingham 2, Ala., or circle No. 3-25 on the reply card.

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Galion 3-5 Ton Tandem Roller



Roller has been completely redesigned and is now equipped with Roll-O-Matic drive

Galion's 3-5 ton variable weight tandem roller has been completely redesigned and is now equipped with Roll-O-Matic drive. It is claimed that the addition of Roll-O-Matic drive on this, the smallest roller in the Galion line, greatly increases its performance and ease of handling. The 3-5 ton roller has all the features used on the larger size Galion tandem rollers, including the same type of sturdy frame and rugged guide roll yoke and hydraulic steering mechanism. A variable speed steering adjustment is provided within easy reach of the operator. Other features include extra-large diameter ballastable rolls, dual operating controls, spur gear final drive enclosed in oil-tight housing and a water-cooled gasoline engine delivering 32 hp at 2400 rpm. The Roll-O-Matic drive is a combination of torque converter, automatic fluid transmission and tail shaft governor. It automatically multiplies power by means of oil instead of gears. Rolling speeds from 0.5 to 5.6 are provided by a two-range transmission. For complete information write to The Galion Iron Works & Mfg. Co., Galion, Ohio, or circle No. 3-26.

Trencher for Any Wheel Type Tractor

The Laster trencher available from Deltec, Inc., can quickly be detached to free a tractor for power tilling, grading, plowing or other jobs. It does not interfere with front-mounted equipment. Any wheel type tractor, with a live power take-off or standard 3-point hitch can be equipped to operate the trencher. An Incher device moves the tractor forward at the correct rate of speed to allow the adjustable steel cutters to dig from 6 to 14-in. wide trenches. The machine moves at speeds up to 500 fph and digs a clean trench to a maximum of 4-ft. depth with standard equipment. A boom extension is available for deeper trenching. For further information write Deltec, Inc., Laster Trencher Div., 185 Industrial Road, Youngstown 9, Ohio, or circle No. 3-27 on the reply card.

Injector Drill for Rotary Drilling Operation

A new hydraulically operated, completely self-contained injector drill, which meets the needs for rotary drilling operation in its class is announced by Houston Tool Co. The unit drills in six different ways: Vacuum: reversed water or mud drilling; standard forced water or mud drilling; diamond drilling by vacuum or water; standard continuous flight auger drilling; and compaction test drilling. The drill will drill at any angle in any kind of formation. It will drill a 2%-in. hole to 150 feet; a 31/s-in, hole to 100 feet: forced water drill to 250 feet; and continuous flight auger drill to 100 feet. It weighs 1800 lbs. and can be mounted in any four-wheel 3/4-ton pickup truck or on a tandem wheel trailer. For more details write Houston Tool Co., P. O. Box 251, Santa Susana, Calif., or circle No. 3-28.

New, Low Cost Snow Attachment Announced for Front-End Loader

A new, inexpensive snow attachment that converts any 66-in. or 72in. wide Anderson & Model E front end loader to a snow bucket has been announced by A. C. Anderson. Quickly attached by eight bolts, the extension provides the extra capacity required for snow removal without interfering with normal loader operation. Even with the snow attachment in place, the loader can be used for handling salt, sand and other materials. High bucket clearance is assured as well as the full dumping feature on all Anderson Loaders. Additional information from A. C. Anderson Inc., Dept. 154, Wildwood, N. J., or circle No. 3-29 on the reply card.

Steam Cleaner

Malsbary announces the Handy Dandy steam cleaner, a new, simplified, low-priced unit designed specifically for use where cleaning operations have seemed too limited for economical steam cleaning; and for larger operations requiring an auxiliary or standby cleaner that is easily moved about the shop or yard. The unit delivers 80 gallons of solution hourly at the same 60-100 pounds cleaning pressure as larger Malsbary steam vapor cleaners. Air atomizing burner assures complete combustion of fuel, thereby eliminating smoke, soot, and eye-irritating fumes. Operator regulates cleaning stream simply by setting burner control to pressure desired. It is offered in two models: oil-fired with caster mounting, or gas-fired for stationary installation. For further information write to Malsbary Mfg. Co., 845 - 92nd Ave., Oakland 3, Calif., or circle No. 3-30 on the reply



Malsbary steam cleaner can be easily moved about the yard, shop or garage

Portable 2500-Watt Electric Generator



Electric generator, made by Pioneer Gen-E-Motor Corp., has an output of 2500 watts and weighs 157 pounds. It is ideal for emergency or standby use

A new model electric generator has been announced by the Pioneer Gen-E-Motor Corp. Having an output of 2500 watts, the 157-pound weight of the model M-2500-P makes it ideal for all uses where portability plus dependable quality are required. The unit features: recoil starting, a plex and twistlock receptacles, pilot light and a sturdy carrying frame. As in all its new models, vibration is practically nil, due to use of special shock pads. Prices and other data from Pioneer Gen-E-Motor Corp., 5841-49 W. Dickens Ave., Chicago 39, Ill., or circle No. 3-31 on the reply card.

Tractor Shovel Has 3-Cu. Yd. Capacity

The Yale & Towne Mfg. Co. has announced the Model 304, which features a completely new functional design and has a rated capacity of 3 cu. yds. It is a 4-wheel drive, pneumatic tired tractor shovel, weighing 27,400 lbs. and with a maximum lifting capacity of 18,000 lbs. The new functional design affords maximum operational efficiency, excellent service accessibility, full 360° visibility, and provides maximum personal safety for the operator. The unit is powered by a 6-cylinder, diesel engine, developing 160 hp at 2,500 rpm. It is equipped with a full power shift, 4-speed, transmission, and a 3.0 to 1 torque multiplying torque converter. The travel speed ranges from 3 mph in low gear to 23 mph in fourth gear, in both forward and reverse. Further information from the Yale & Towne Mfg. Co., Trojan Division, Batavia, N. Y., or circle No. 3-32 on the reply card.

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Director, Advertising & Research

ADVERTISING OFFICES

Ridgewood, N. J., 200 So. Broad St. W. S. Morris, Eastern Sales Mgr.

Cleveland 10, Ohio, Villa Beach 2, 15445 Lake Shore Blvd. Burton M. Yost, District Mgr.

Chicago 11, III., 612 N. Michigan Ave. Robert J. Shea, Mid-West Sales Mgr. Roderick Ellis Los Angeles 36, Calif. 5478 Wilshire Blvd. Hugh Hollyday, % Smith & Hollyday David W. Zander

San Francisco 4, Calif., Russ Building Bill Smith, % Smith & Hollyday

Kansas City 15, Mo., 4117 West 67th C. H. Stockwell

WORTH SEEING

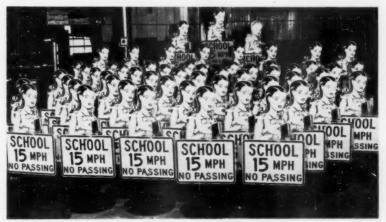




The AASHO test road near Ottowa, Illinois, will be photographed at intervals over a two-year period to measure wearing qualities of paving materials. Picture above is one half of continuous stereo strip photograph made by shutterless camera in Chicago Aerial Survey's airplane. Original print is made at a scale of 1 inch equals 50 feet.



Testing two 144-in. ID 24-ft. sections of concrete pressure pipe at once for the Los Angeles Hyperion Treatment Plant effluent ocean outfall, now under construction. Maximum test pressure of 53 psi develops nearly a million pounds of thrust on each of the heads. Pipe was made by United Concrete Pipe Corp.



These are the first delivery of "Safety Sue" portable school zone signs to the City of Wichita, Kans. Made by the Miro-Flex Co. of Wichita, the eye-catching "Safety Sues" have a full embossed 27" by 20" sign giving speed limit and no passing instructions. They will be used to indicate school zones throughout the city.



The problem of quickly and effectively handling the compaction of the steep slopes of a Long Beach, Calif., bridge approach was solved by using a specially designed 1500 lb. roller on a 6 ft. boom extension attached to the regular boom of a standard truck-mounted Gradall. The weight of the roller in combination with the powerful boom downthrust did the job in record time.

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FOR EVERY MUNICIPAL PROTECTION NEED!

- Water Works
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Famous Master Laminated Padlocks

Multiple steel plates
, . . stronger than a
solid block! Genuins
brass-cylinder, pintumbler security. No
finer padlock protection.



Double-wall construction . . . 3 number bress locking mechanism. Available with "Key-Control" — one control key opens all locks.





Special Long or Short Shackles

For switch boxes, chains, truck or freight car doors, and other uses where special shackle lengths are more desirable.



Master's Service Department is geared for fast delivery . . in emergencies, special erders are on the way within hours!



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Master Lock Company, Milwaukee 45. Wis. World's Largest Padlock Manufacturers



by Arthur K. Akers

- ★ ROBERT D. BUTLER is appointed sales manager, plug valves, for W-K-M Division of ACF Industries Inc., in Houston.
- ★ ROBERT LOCKWOOD, formerly an associate editor of Civil Engineering magazine, appointed advertising manager of Sika Chemical Corporation (concrete additives as now advertised in Public Works).
- ★ LUTHER L. SMITH, executive vice president, Smith Blair Inc., South San Francisco, has gone to Washington on loan as adviser to the Water and Sewerage Industry and Utilities Division, U. S. Department of Commerce.





Mr. Smith

Mr. Cornell

- ★ WILLIAM C. CORNELL is new general sales manager, Seaman-Andwall Corporation, Milwaukee.
- ★ DORR-OLIVER Inc. opens another sales office, Pittsburgh 27, Pa., with D. R. Vaughn as sanitary sales engineer.
- ★ HERSEY MANUFACTURING CO. adds Charles R. Dyas to their Chicago sales staff.
- ★ LOREN H. BONNETT is named general sales manager, Josam Manufacturing Co., Michigan City, Ind.
- ★ ROBERT ORSER is promoted to advertising manager, chain saw division, McCulloch Corporation, Los Angeles.
- ★ COCHRANE CORPORATION, Philadelphia, names George E. Glover, manager of its Industrial Waste Department.
- ★ LESTER F. KUZMICK is new vice-president, Felker Manufacturing Co., Torrance, Calif., concrete cutting saws.

★ ALFRED F. MANSBACH becomes advertising and sales promo-



tion manager, Tractor Division, Eimco Corporation, Salt Lake City. "Al" was formerly a vice-president of Robert A. Luckie & Company, advertising agency in Birmingham,

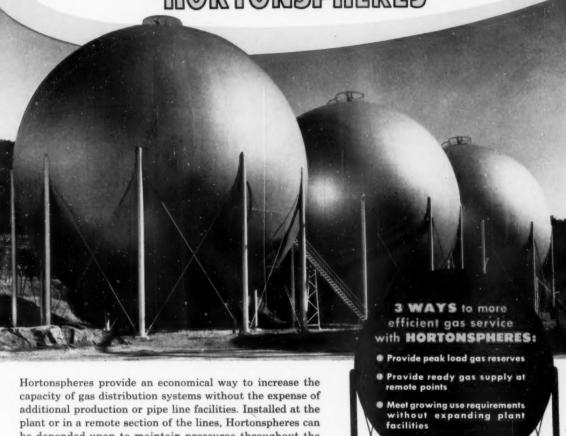
Mr. Mansbach

Ala., where we shall definitely miss him on our personal rounds in the South.

- ★ ALLIS CHALMERS MANU-FACTURING CO., announces acquisition of the S. Morgan Smith Company plant, henceforth to be known as its "York Works." The Smith plug, butterfly and sphericaltype valves will continue to be made there, with Beauchamp E. Smith as general manager of the hydraulic division and Burwell B. Smith assistant general manager, sales.
- ★ PORTLAND CEMENT ASSOCI-ATION begins field service activities in Northern California, opening an office in San Francisco, Charles F. Moran and Robert E. Jones will staff it.
- ★ "QUICK WAY" Truck Shovel Co., Denver, announces new board members and officers, with Gilbert S. Rigdon, executive vice-president, T. S. Petersen, sales manager.
- ★ LATEST progressive move of the Cast Iron Pipe Research Association: appointment of J. Walter Thompson Co. as public relations counsel.
- ★ C. E. "Skip" JONES is named manager of engine sales, International Harvester's Construction Equipment Division. He was formerly divisional supervisor of sales engineering and development.
- ★ DAVID J. (DAVE) PURDIE, long New York sales representative of B-I-F Industries died suddenly in January. Widely known, he retired in 1958 after 47 years with Builders.
- ★ FRIEND: "What is your son going to be when he passes his final exam?" Father: "An old man."

PUBLIC WORKS for March, 1959

Smooth out Gas Supply Problems Efficiently, Economically with HORTONSPHERES



be depended upon to maintain pressures throughout the day-or can be used only at peak load periods.

In addition, Hortonspheres require less ground area for a given amount of storage than low pressure storage methods. They have no operating parts and require little attention. They present a pleasing appearance and the smooth, welded steel structure is easy to paint and maintain.

The Hortonsphere is another example of how CB&I's craftsmanship in steel is helping modern communities to meet their growth problems, gracefully . . . at a minimum of cost as compared to the efficiency delivered. Write your nearest CB&I office for further information.

New, tougher steels with higher yield strength and continuing improvements by CB&I in design, testing, fabricating, and erection techniques and equipment have considerably extended the volume of gas that can now be stored at high pressure. Write for details.

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Three 76-ft. diameter Hortonspheres serve growing gas requirements at Meriden, Connecticut for the Connecticut Power and Light Company.

THE V·NOTCH MEETS FUTURE DEMANDS TOO

Calendar for 1979

They tell us it's a growing America.

It is.

You know already you'll need to expand to keep pace with demand.

That's why the V-notch Chlorinator has such tremendous range. The precision shaped groove in a V-notch plug is made to control chlorine completely to one eight-hundredth of the maximum capacity of your machine. In fact, this is standard in some of the V-notch chlorinators.

Your W&T representative will help you size your V-notch chlorinator so that when your treatment needs step up—you simply snap in the next size rotameter. Without buying a new machine, you get the same quick, accurate control in a new working feed range.

And, of course, the right plastics make the whole chlorinator chlorine-proof.



Chlorinator features. For your copy

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